Fig. 1

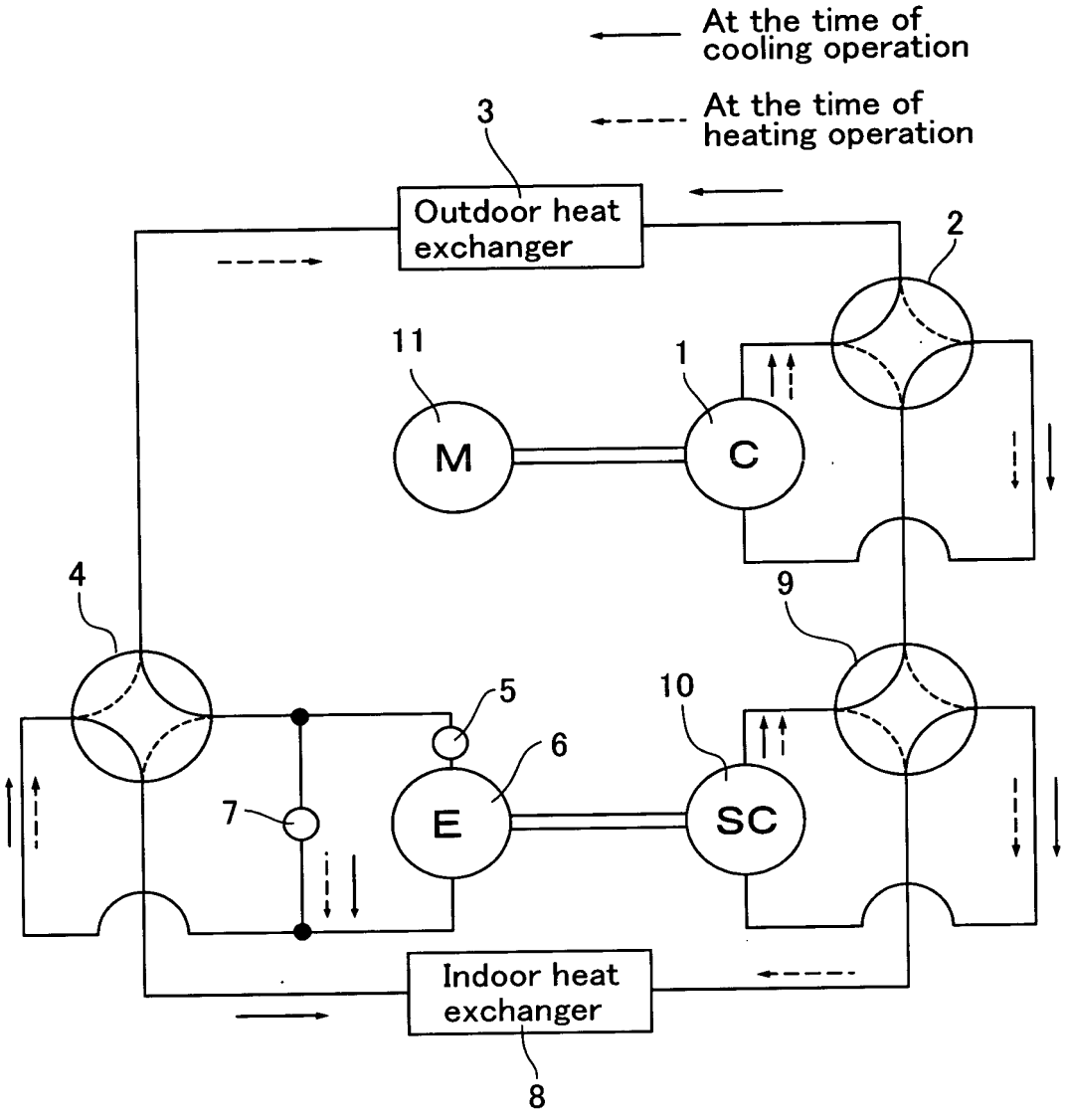

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
2
11
1
M
C
4
9
5
10
6
7
E
SC
Indoor heat exchanger
8

Fig. 2

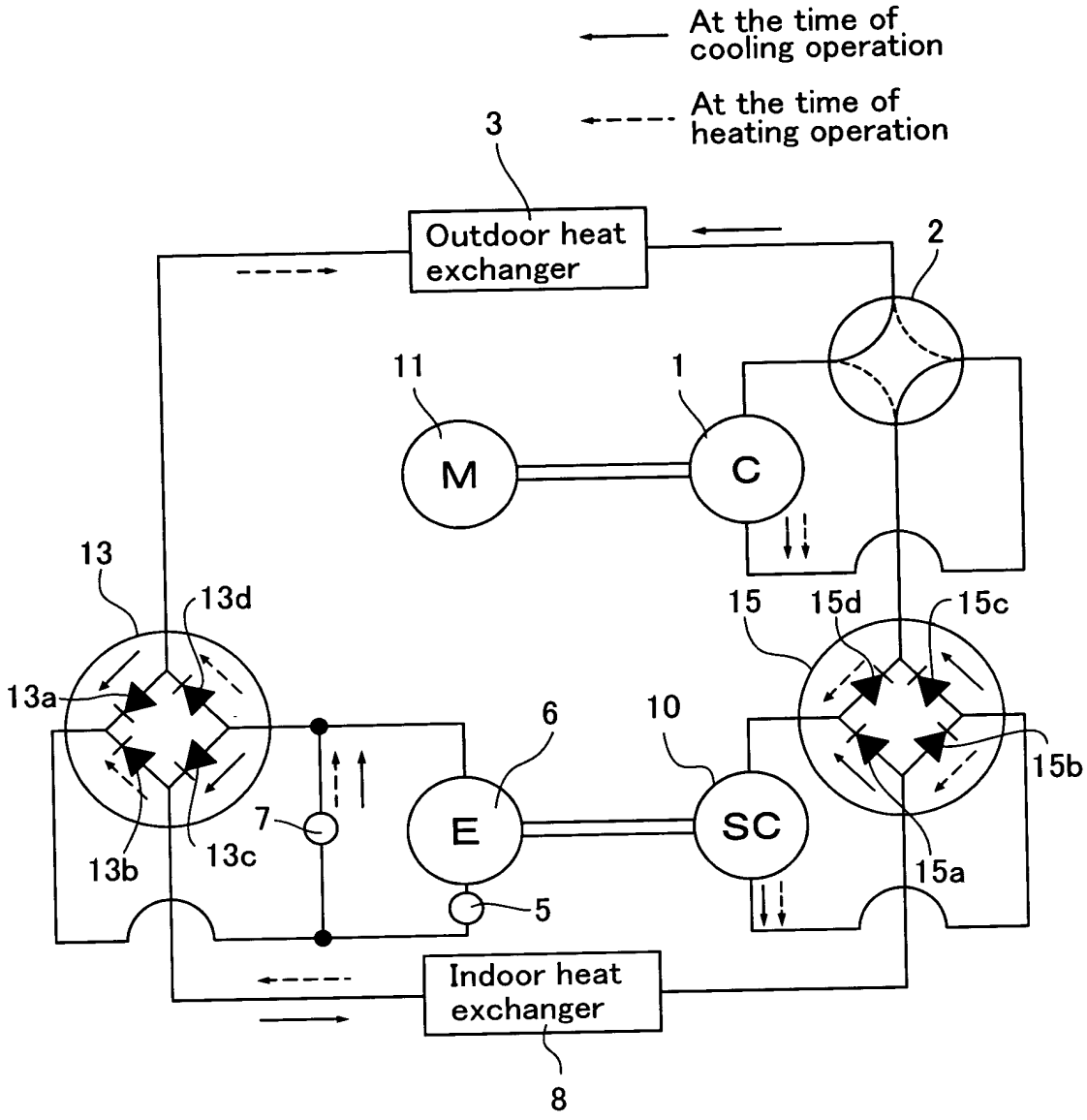

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
2
11
1
M
C
13
13d
15
15d
15c
13a
6
10
15b
7
E
SC
13b
13c
15a
5
Indoor heat exchanger
8

Fig. 3

Fixed density ratio

	At the time of cooling operation		At the time of heating operation	
	Rated operation	1/2 rated operation	Rated operation	1/2 rated operation
Supercharger mode	4.09	3.36	8.50	8.02
Super-pressurizing mode	3 00	2.65	5.99	5.29

	Rated operation	1/2 rated operation	Rated operation	1/2 rated operation
Switching system between supercharger mode and super-pressurizing mode	4.09	3.36	5.99	5.29

Fig. 4

COP value

		Present invention	Comparative example	
		Switching system between supercharger mode and super-pressurizing mode	Bypass valve and pre-expansion valve system	Electric generator system
At the time of heating operation	Rated operation	5.456	5.302	5.547
	1/2 rated operation	5.672	5.490	5.781
At the time of cooling operation	Rated operation	4.862	4.862	4.504
	1/2 rated operation	5.089	5.089	4.943
Average COP value (rated)		5.159	5.082	5.026

Fig. 5

Frequency range (estimation)		Main compressor frequency	Frequency ratio	Auxiliary compressor frequency
At the time of heating operation	Rated operation	60	0.6545	39.3
	1/2 rated operation	30	0.6131	18.4
At the time of cooling operation	Rated operation	40	1.000	40
	1/2 rated operation	20	0.9824	19.6

Fig. 6

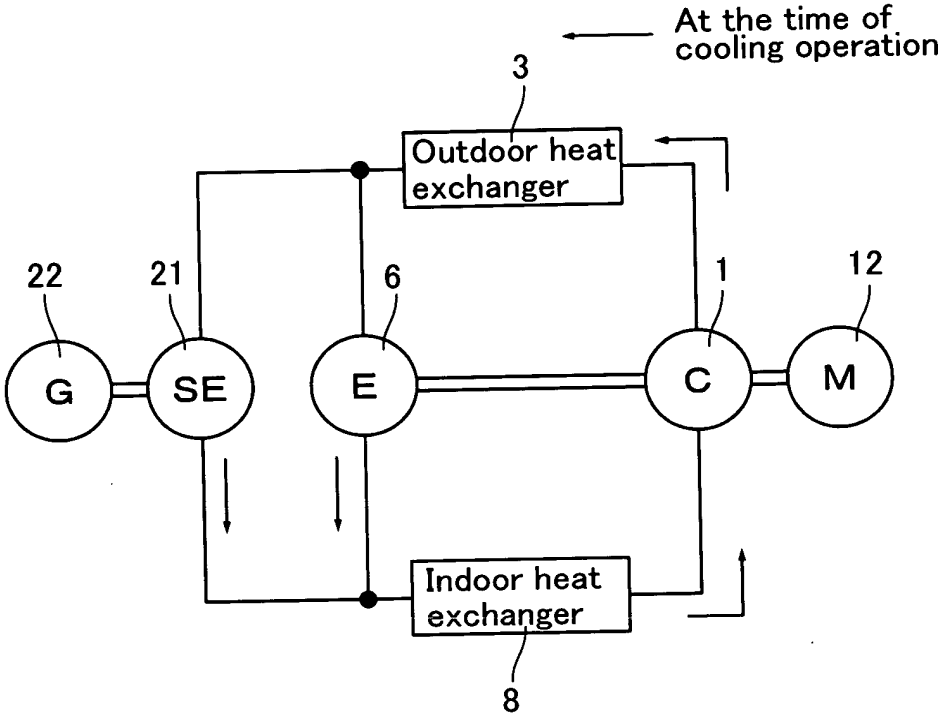
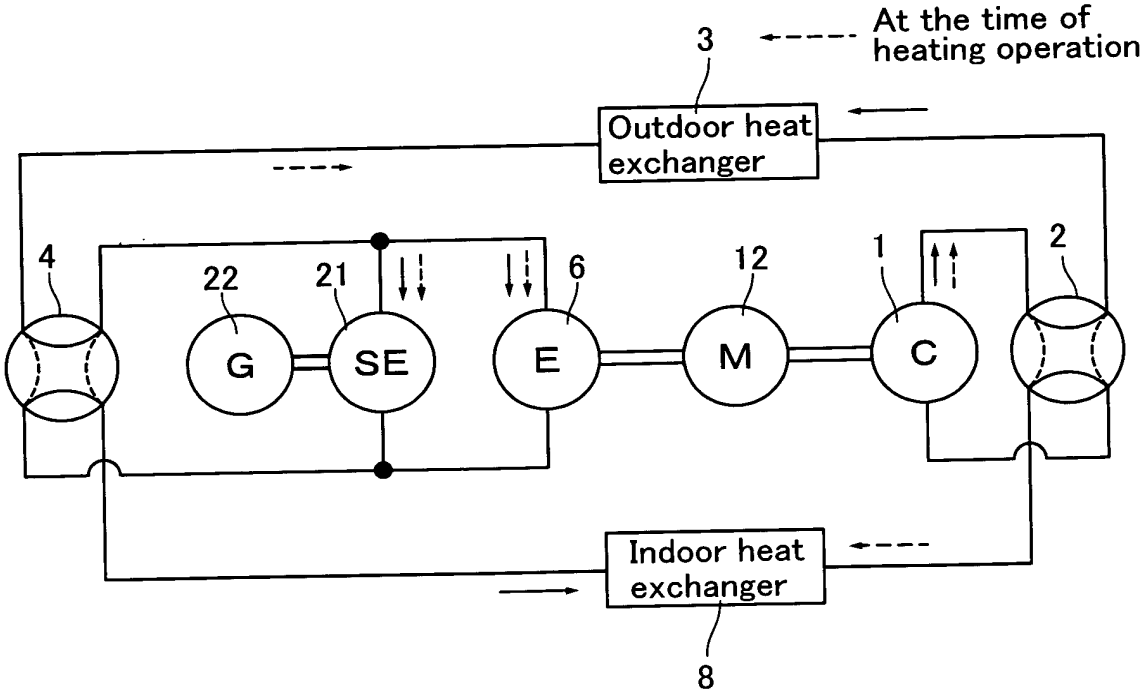

At the time of cooling operation
3
Outdoor heat exchanger
22
21
6
1
12
G
SE
E
C
M
Indoor heat exchanger
8

Fig. 7


At the time of cooling operation
At the time of heating operation
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Outdoor heat exchanger
4
22
21
6
12
1
2
G
SE
E
M
C
Indoor heat exchanger
8

Fig. 8

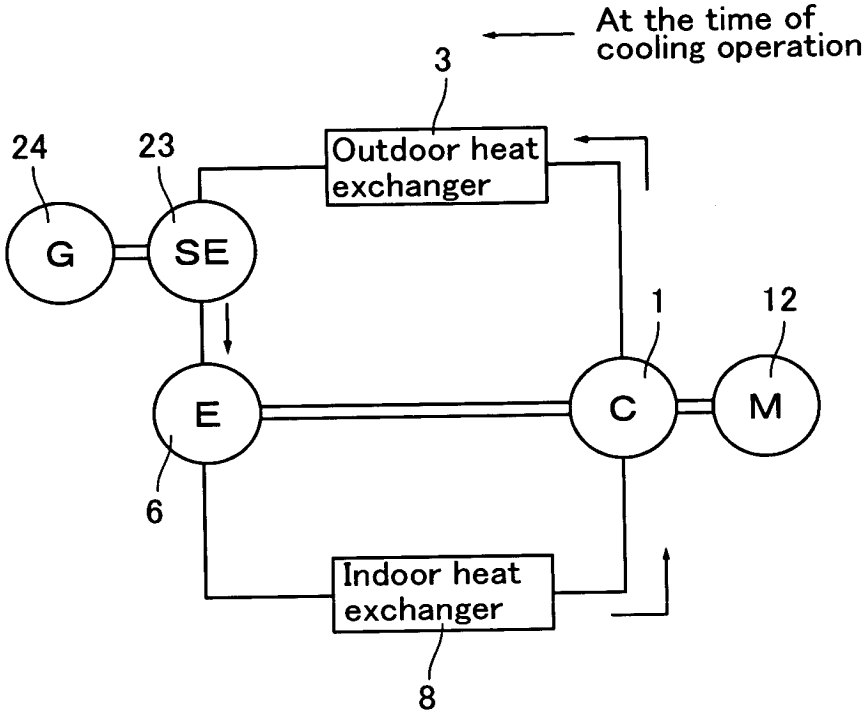

At the time of cooling operation
3
Outdoor heat exchanger
24
23
G
SE
1
12
E
C
M
6
Indoor heat exchanger
8

Fig. 9

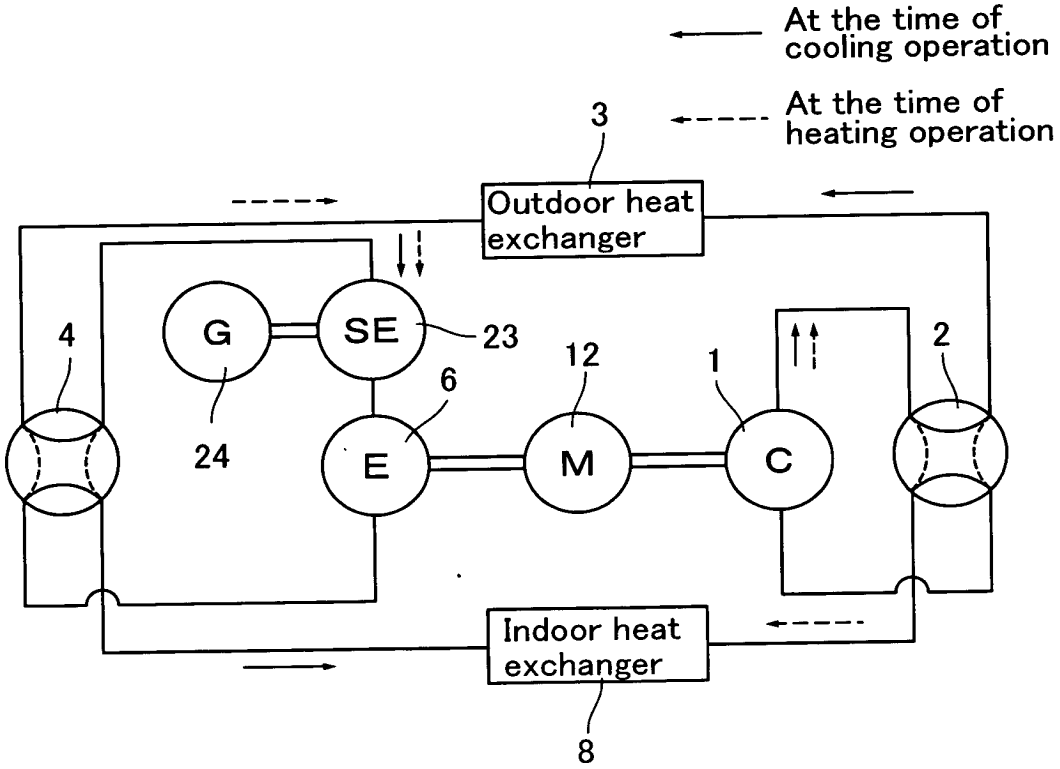

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
4
G
SE
23
12
1
2
6
24
E
M
C
Indoor heat exchanger
8

Fig. 10

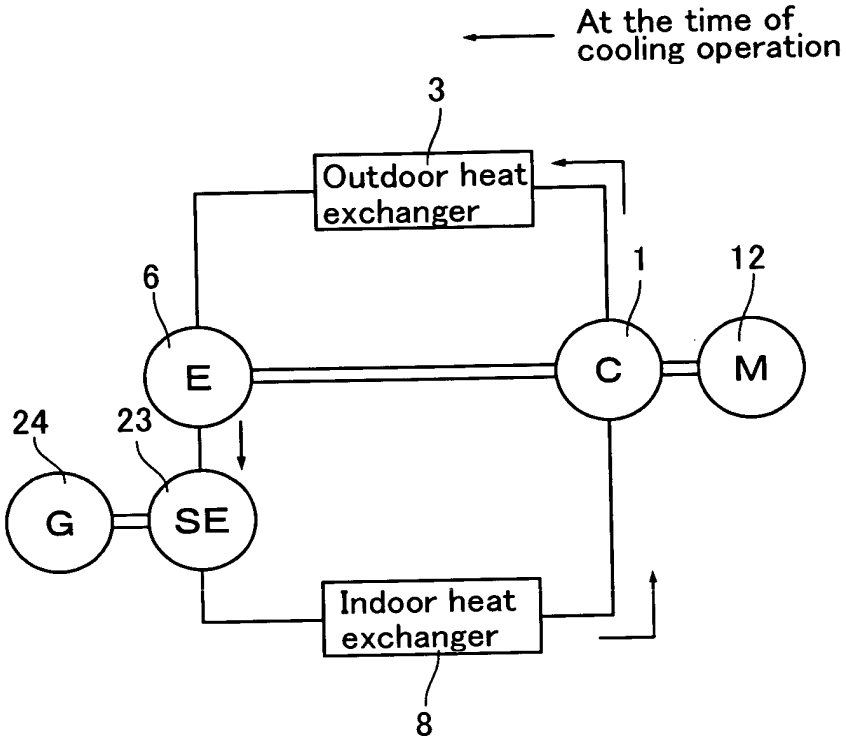
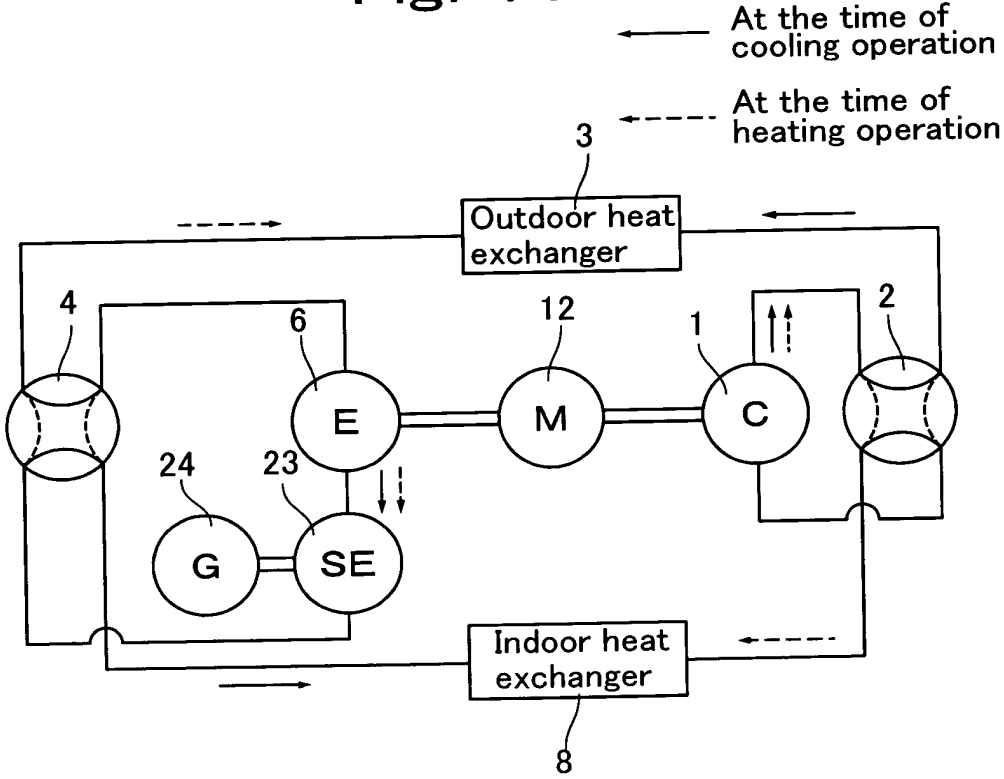

At the time of cooling operation
3
Outdoor heat exchanger
6
1
12
E
C
M
24
23
G
SE
Indoor heat exchanger
8

Fig. 11


At the time of cooling operation
At the time of heating operation
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Outdoor heat exchanger
4
6
12
1
2
E
M
C
24
23
G
SE
Indoor heat exchanger
8

Fig. 12

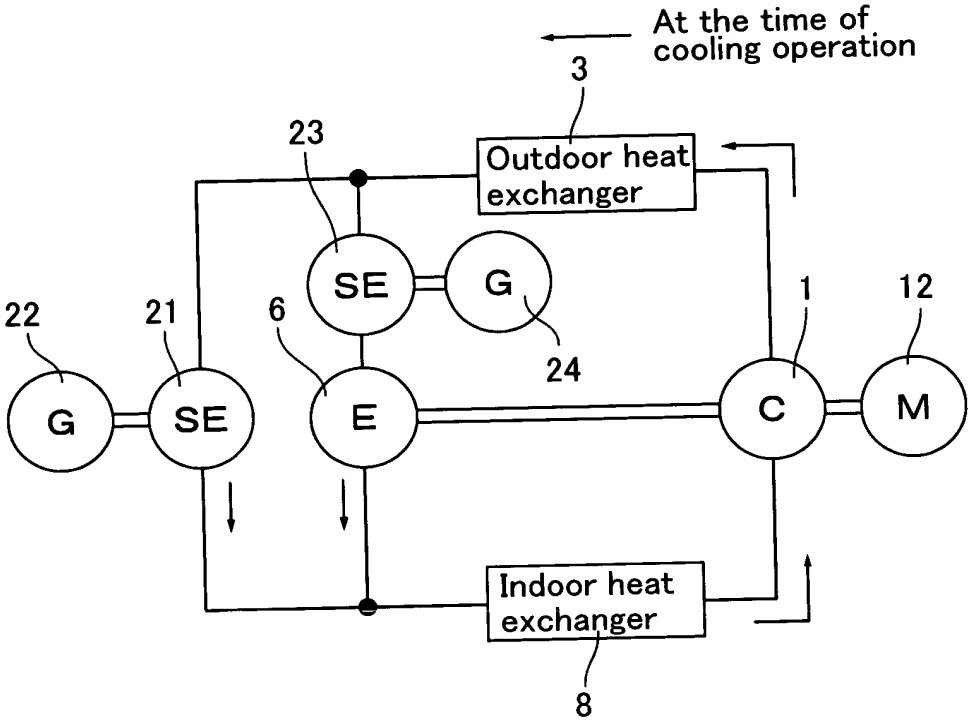

At the time of cooling operation
3
23
Outdoor heat exchanger
SE
G
22
21
6
1
12
24
G
SE
E
C
M
Indoor heat exchanger
8

Fig. 13

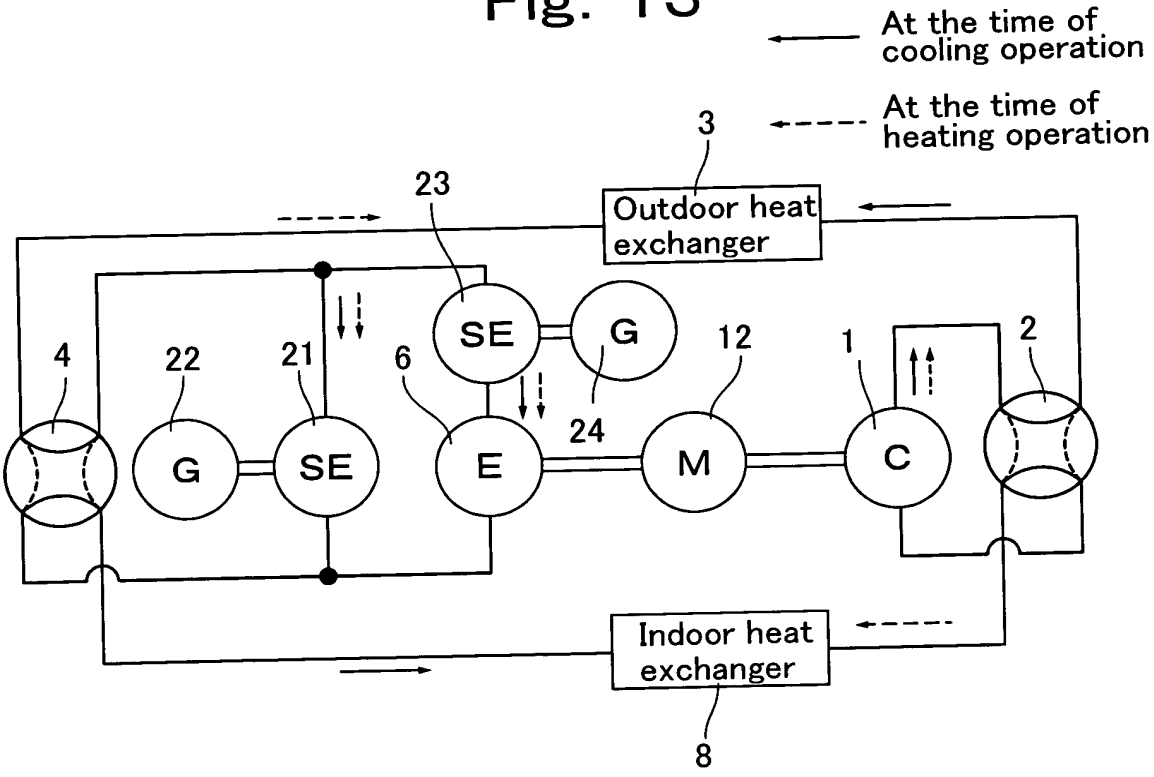

At the time of cooling operation
At the time of heating operation
3
23
Outdoor heat exchanger
SE
G
4
22
21
6
12
1
2
24
G
SE
E
M
C
Indoor heat exchanger
8

Fig. 14

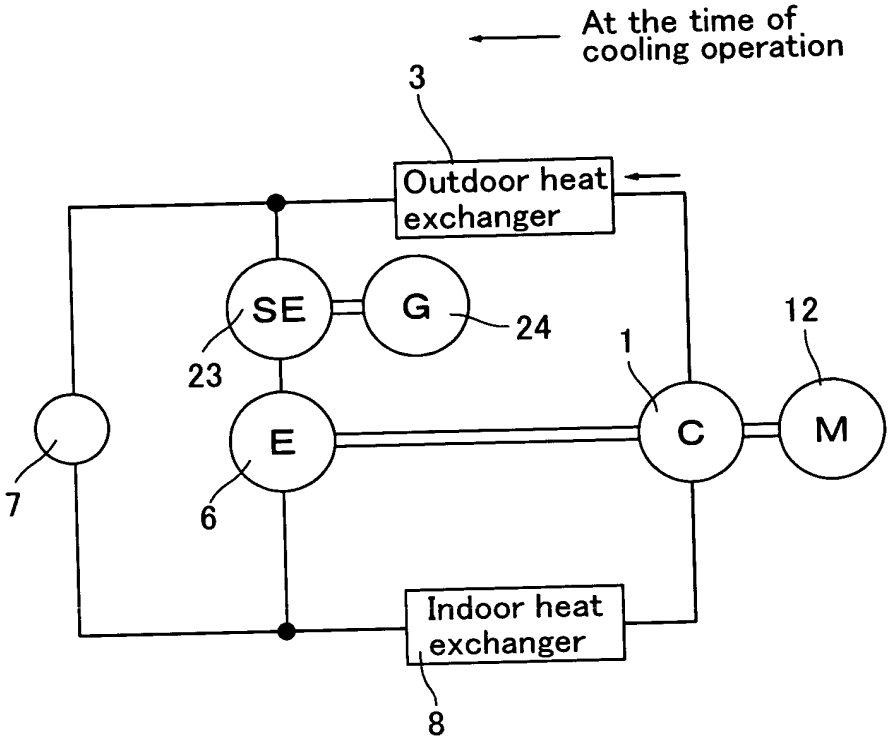

At the time of cooling operation
3
Outdoor heat exchanger
SE
G
24
23
12
1
E
C
M
7
6
Indoor heat exchanger
8

Fig. 15

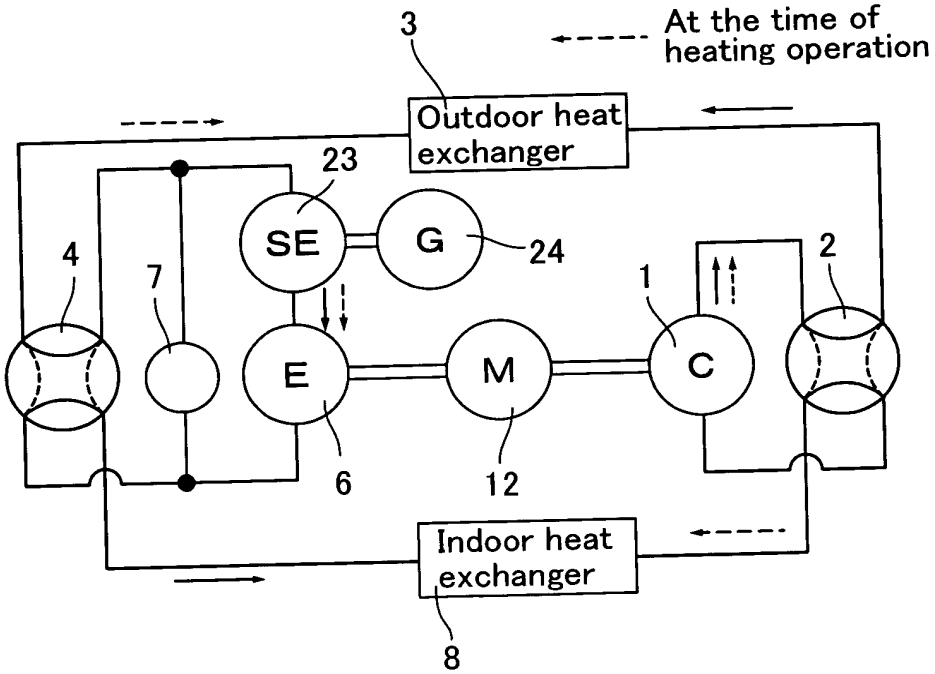

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
23
SE
G
24
4
7
1
2
E
M
C
6
12
Indoor heat exchanger
8

Fig. 16

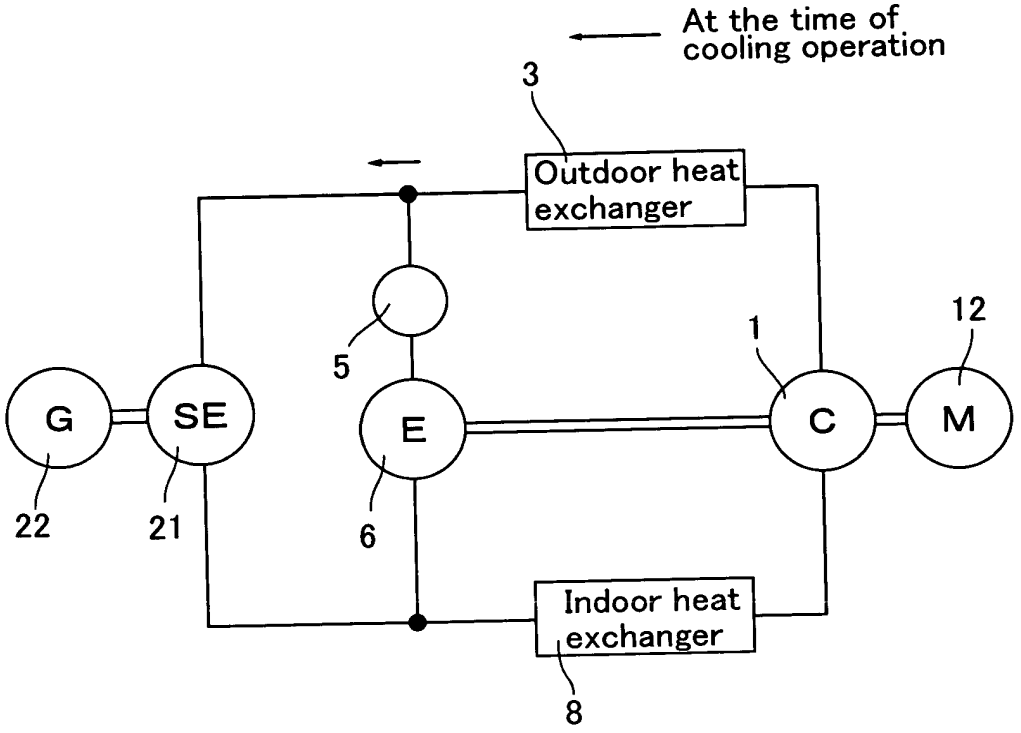

At the time of cooling operation
3
Outdoor heat exchanger
5
1
12
G
SE
E
C
M
22
21
6
Indoor heat exchanger
8

Fig. 17

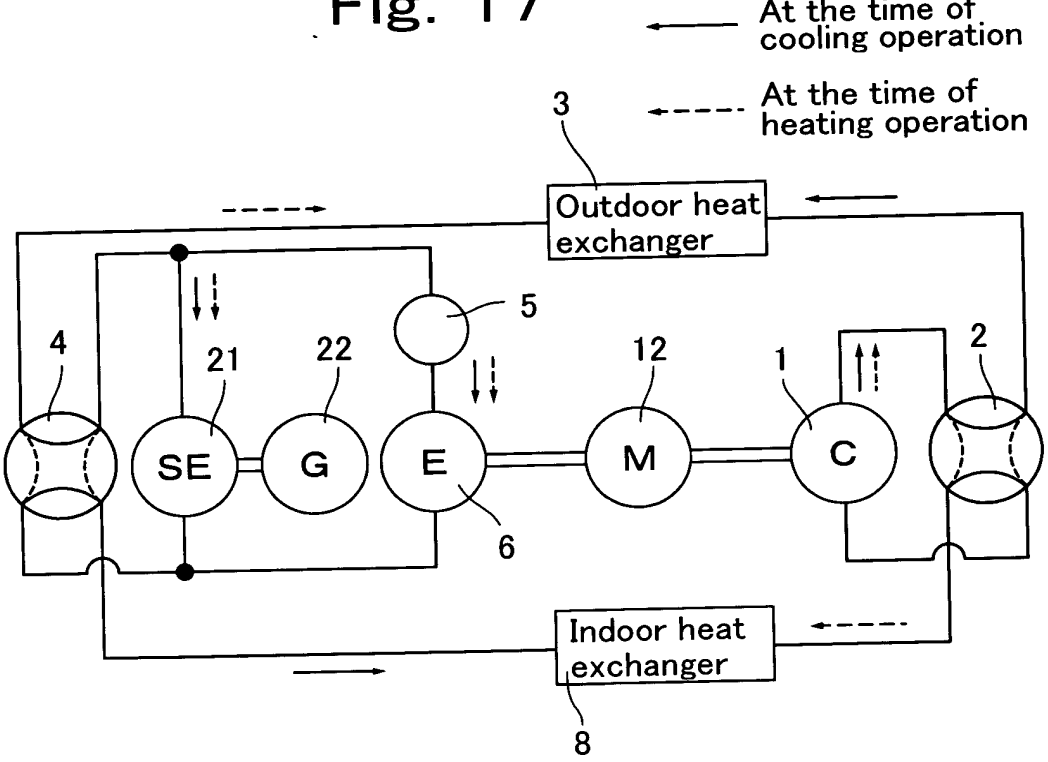
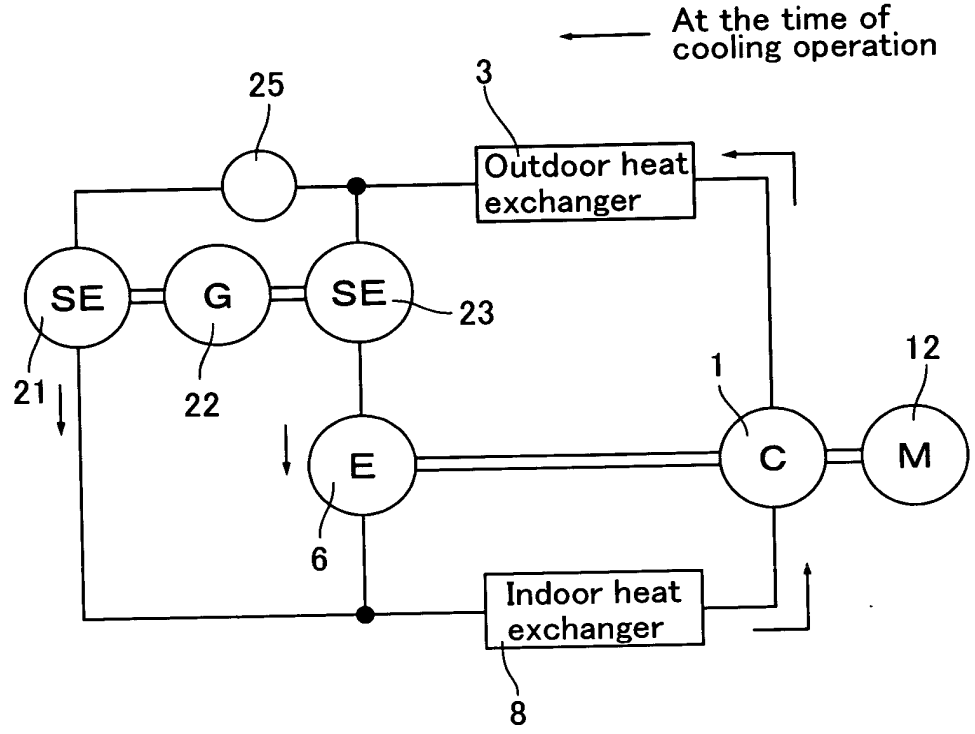

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
5
4
21
22
12
1
2
SE
G
E
M
C
6
Indoor heat exchanger
8

Fig. 18


At the time of cooling operation
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3
Outdoor heat exchanger
SE
G
SE
23
21
22
1
12
E
C
M
6
Indoor heat exchanger
8

Fig. 19

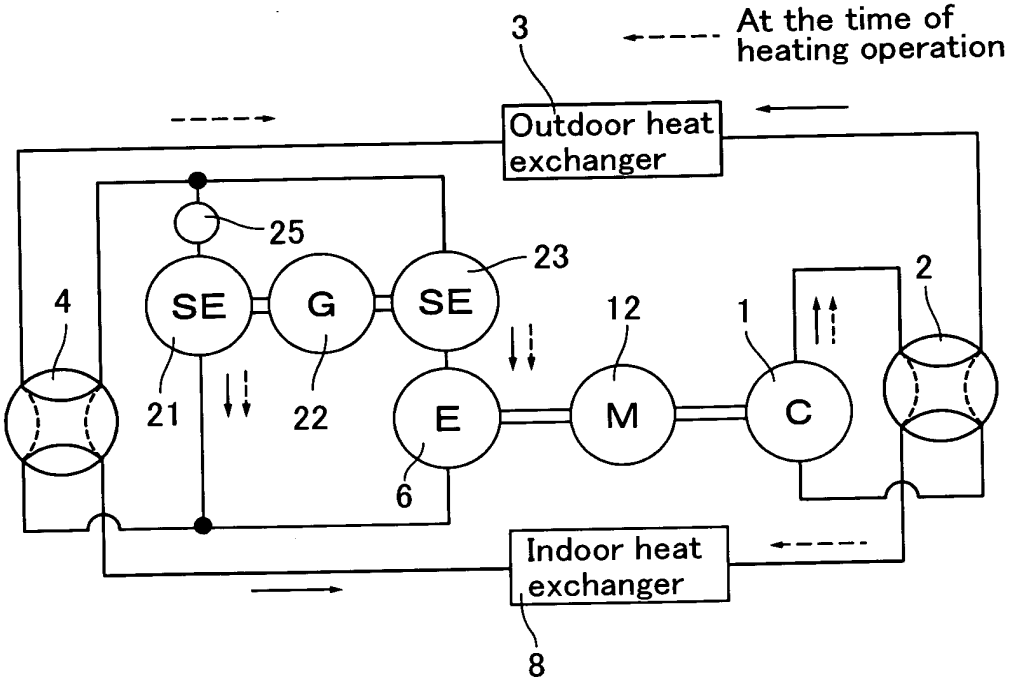
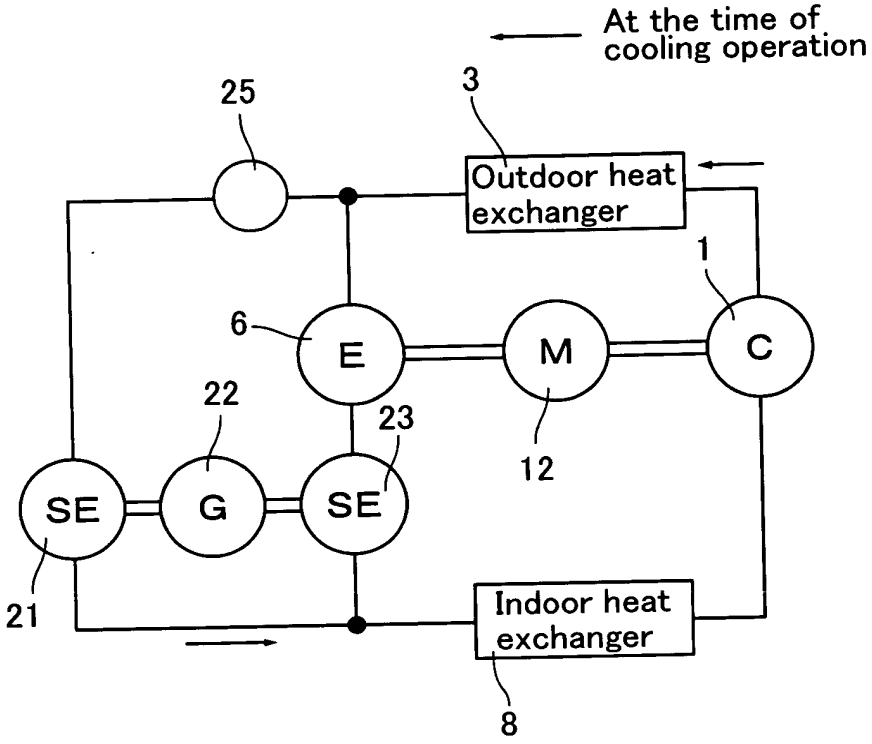

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
25
23
2
4
SE
G
SE
12
1
21
22
E
M
C
6
Indoor heat exchanger
8

Fig. 20


At the time of cooling operation
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Outdoor heat exchanger
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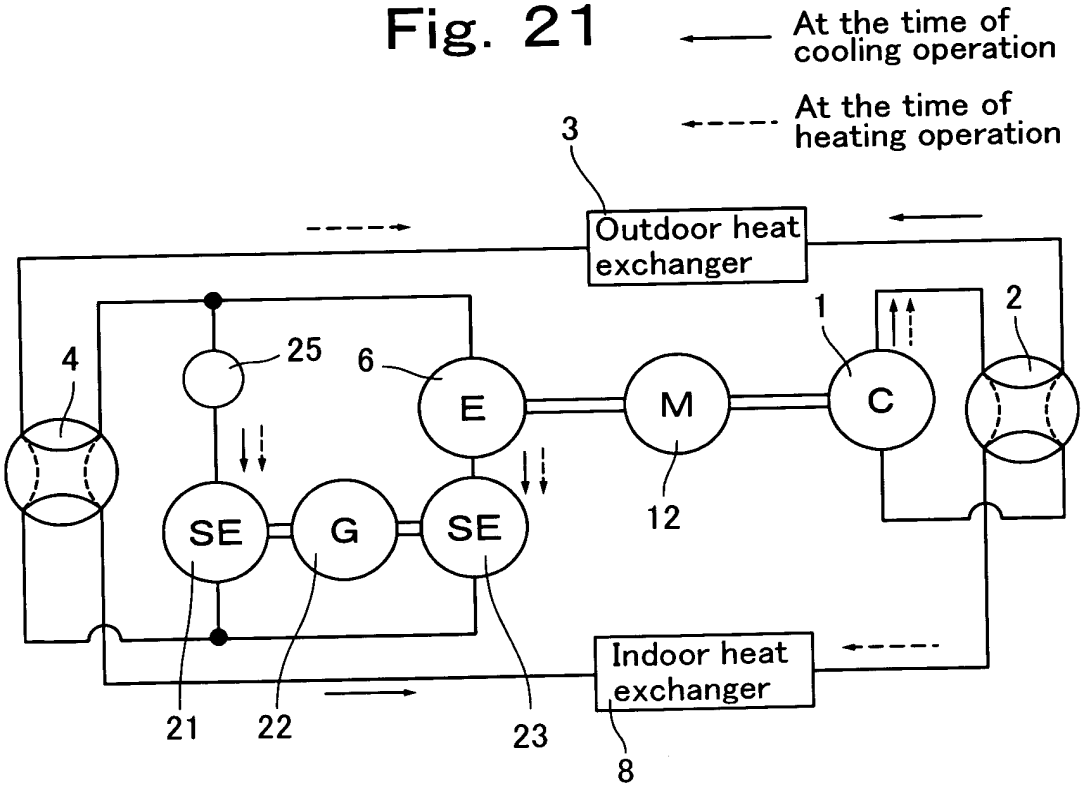
6
E
M
C
22
23
12
SE
G
SE
21
Indoor heat exchanger
8

Fig. 21


At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
1
2
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25
6
E
M
C
12
SE
G
SE
21
22
23
Indoor heat exchanger
8

Fig. 22

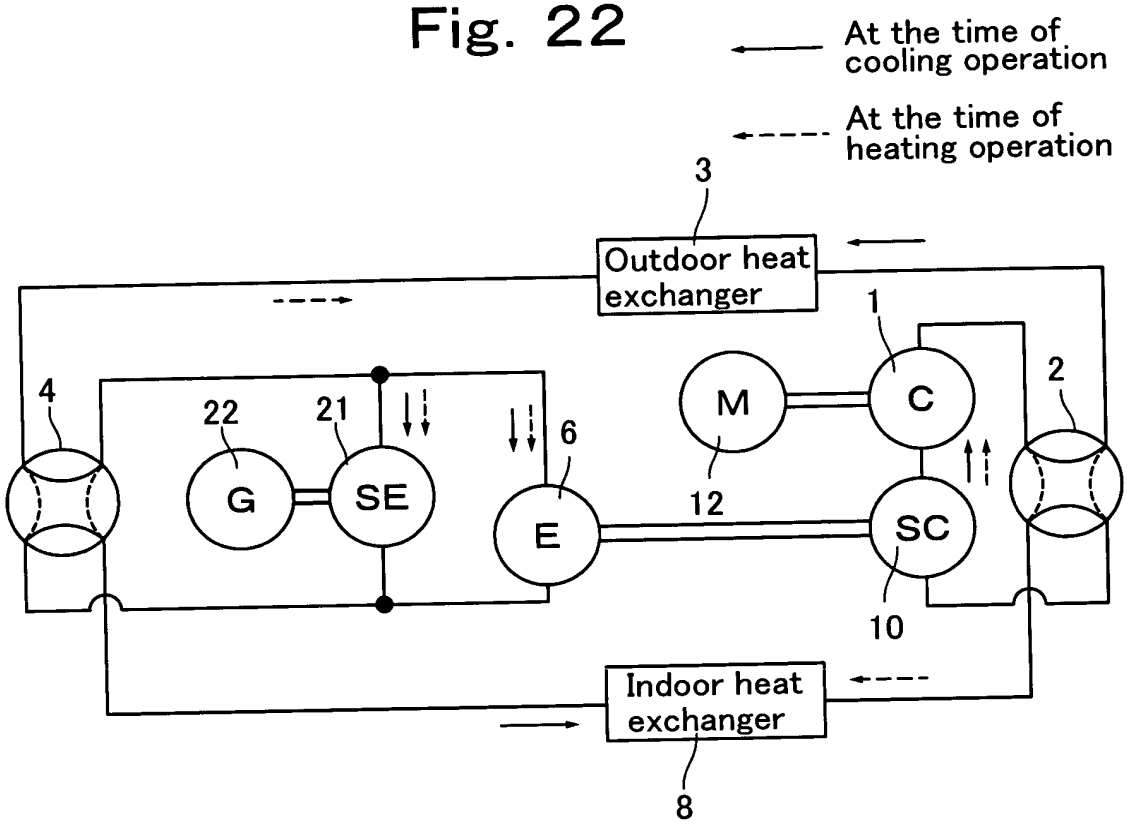

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
1
2
4
22
21
6
M
C
G
SE
E
12
SC
10
Indoor heat exchanger
8

Fig. 23

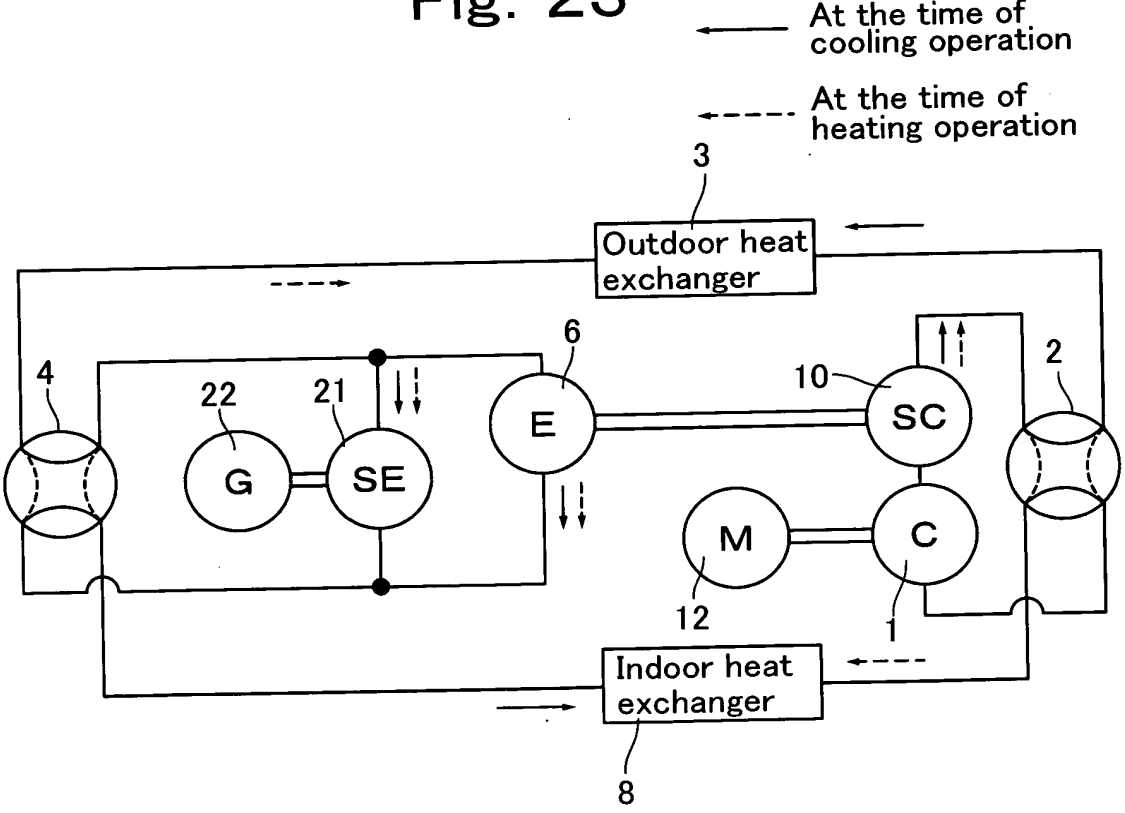

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
6
2
4
10
22
21
E
SC
G
SE
M
C
12
1
Indoor heat exchanger
8

Fig. 24

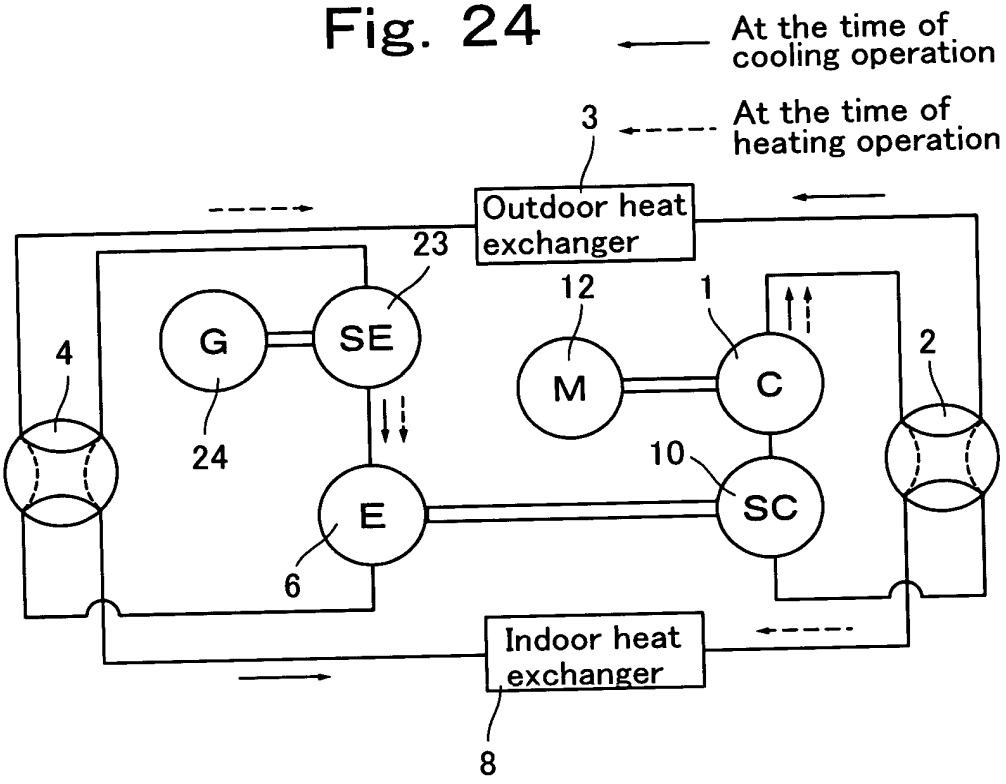

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
23
12
1
G
SE
M
C
2
4
24
10
E
SC
6
Indoor heat exchanger
8

Fig. 25

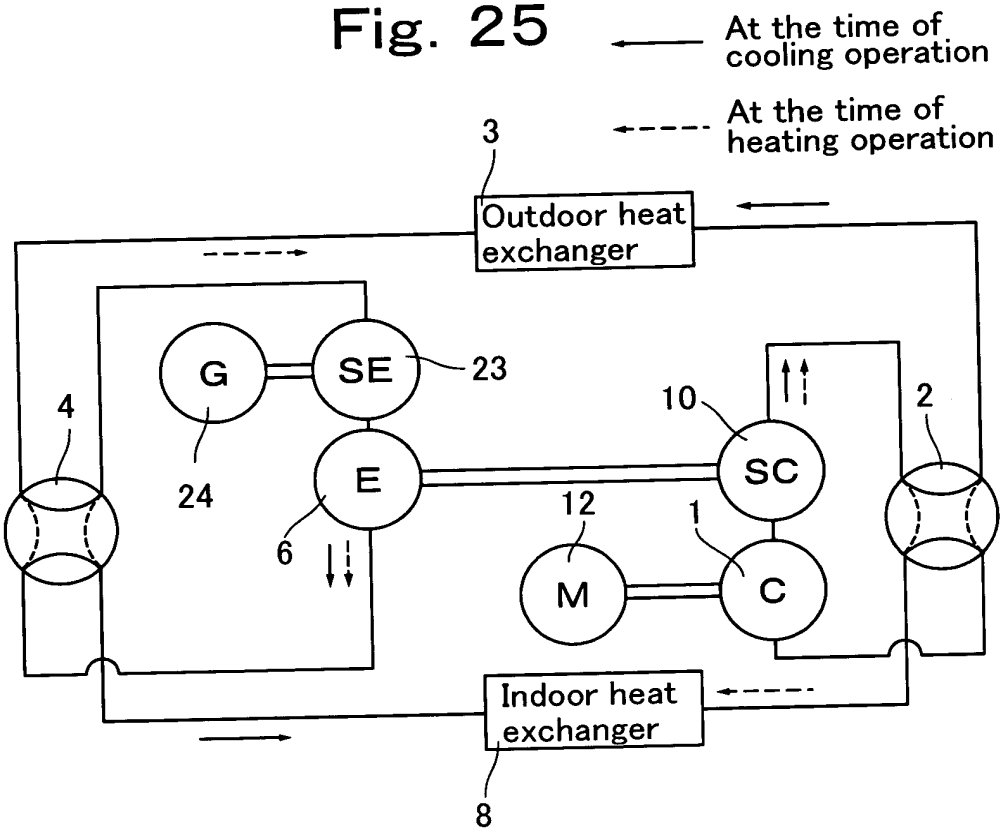

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
G
SE
23
10
2
4
E
SC
24
12
1
6
M
C
Indoor heat exchanger
8

Fig. 26

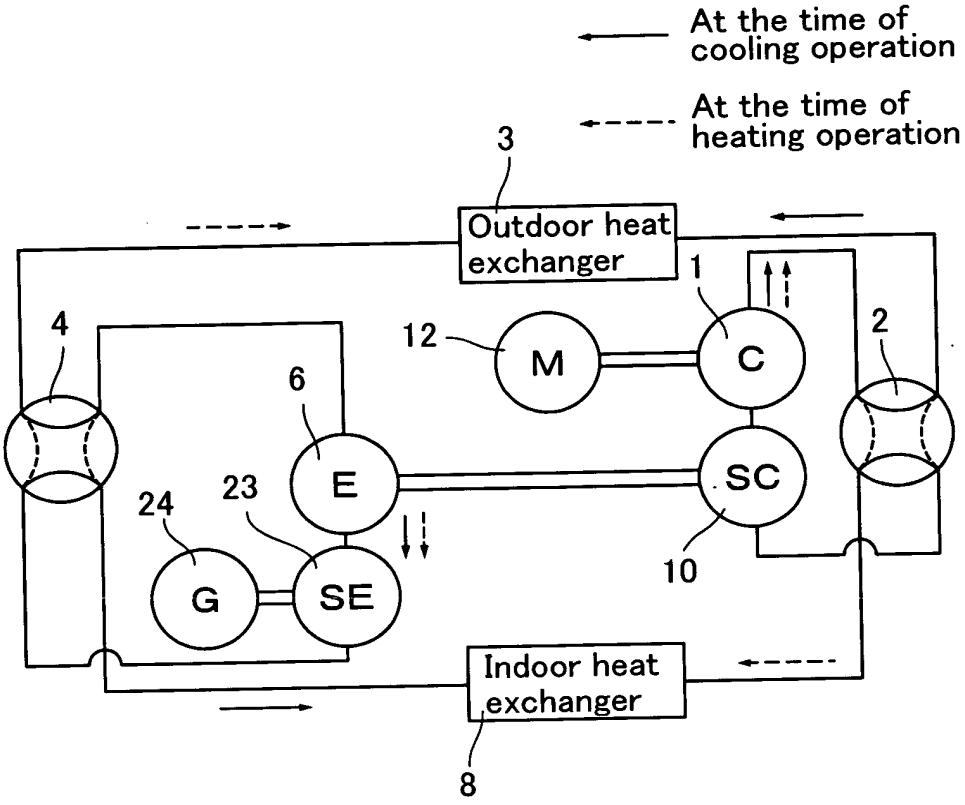

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
1
2
4
12
M
C
6
E
SC
23
24
G
SE
10
Indoor heat exchanger
8

Fig. 27

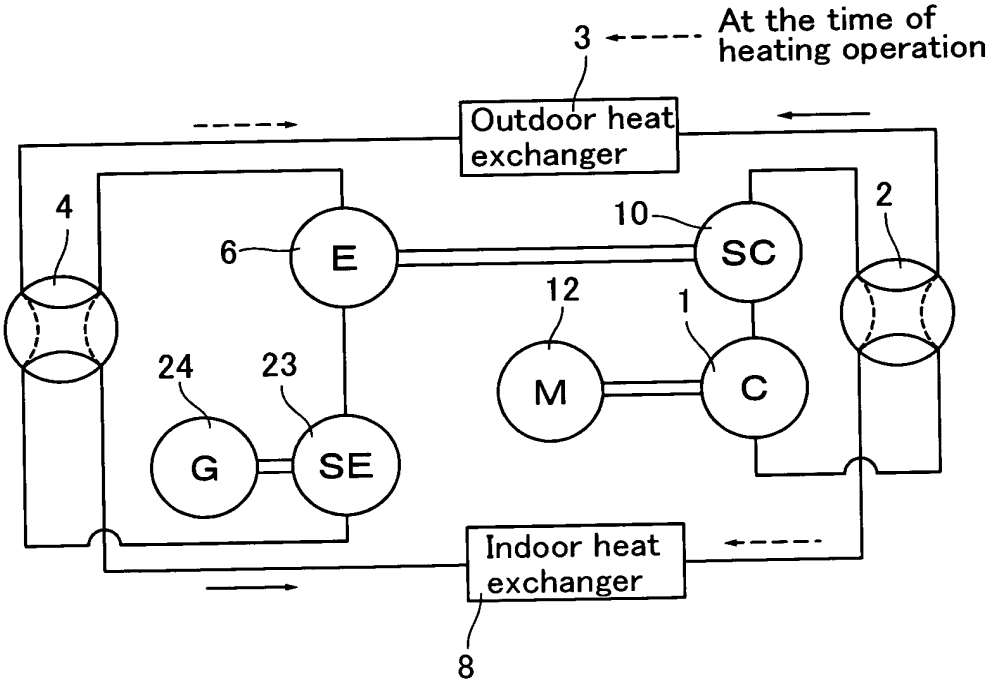

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
4
10
2
6
E
SC
12
1
24
23
M
C
G
SE
Indoor heat exchanger
8

Fig. 28

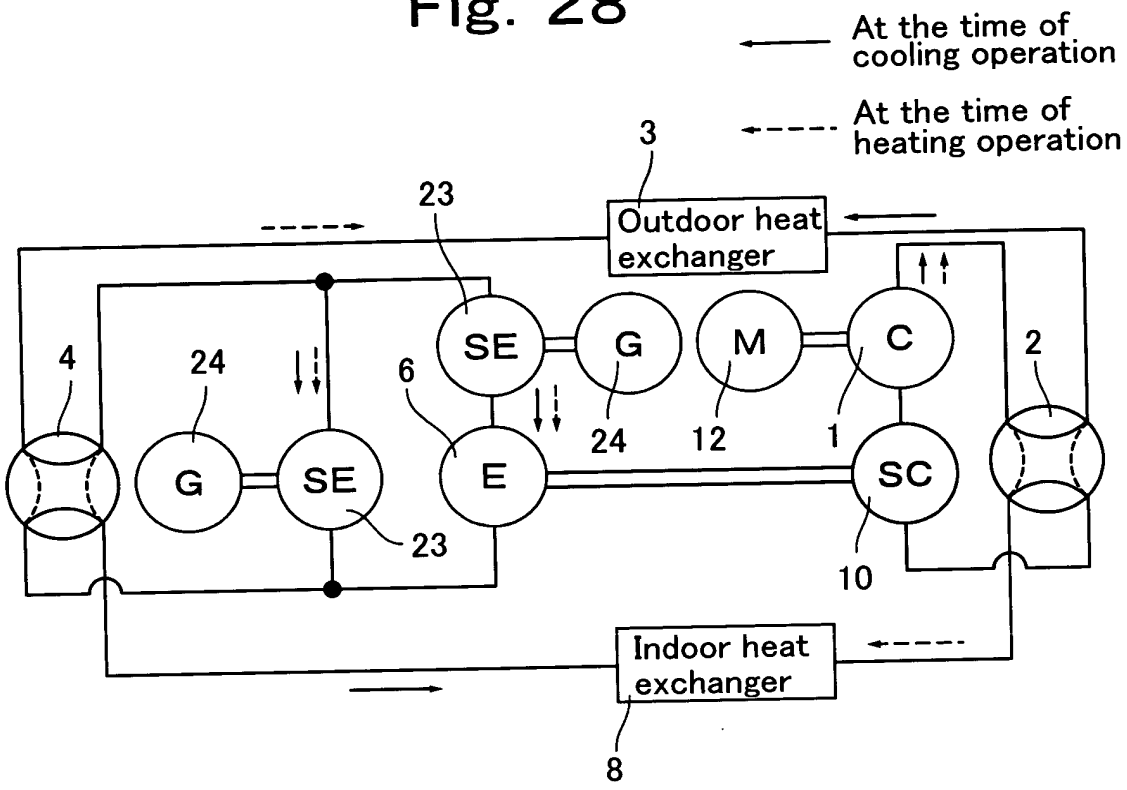

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
23
SE
G
M
C
2
4
24
6
24
12
1
G
SE
E
SC
23
10
Indoor heat exchanger
8

Fig. 29

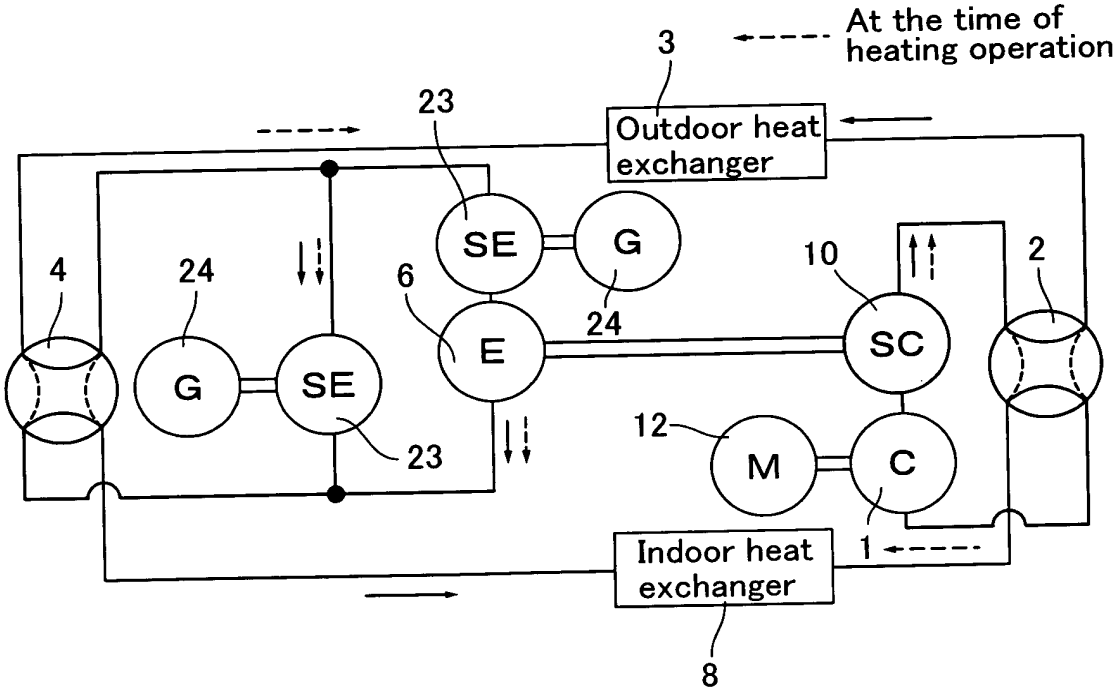

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
23
SE
G
10
2
4
24
6
24
E
SC
G
SE
23
12
M
C
1
Indoor heat exchanger
8

Fig. 30

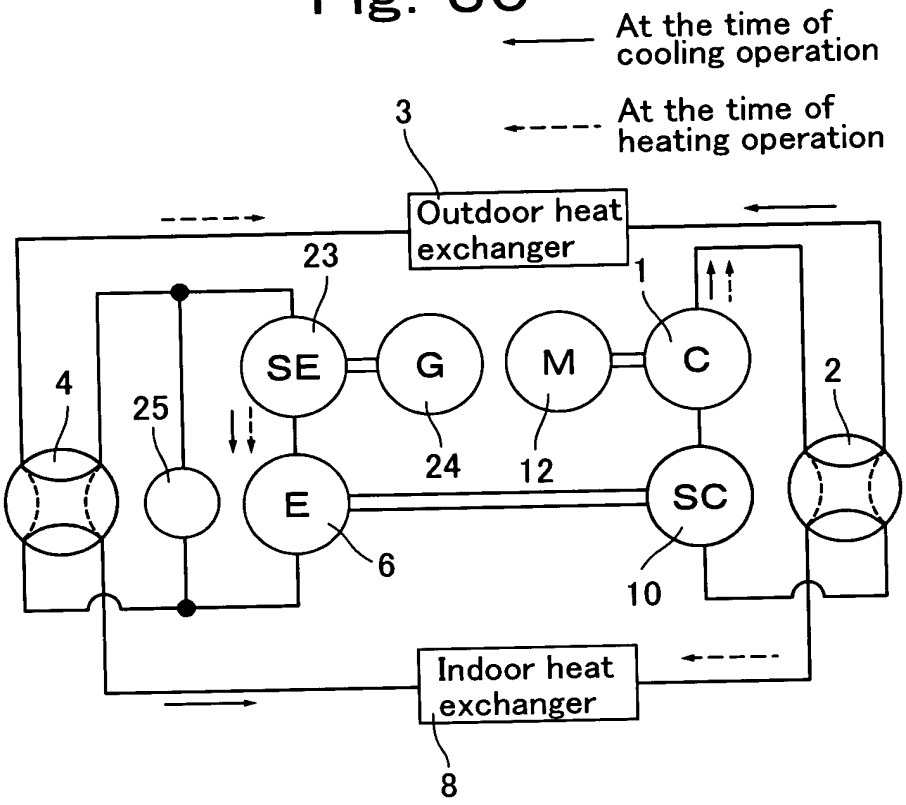

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
23
1
SE
G
M
C
4
25
2
24
12
E
SC
6
10
Indoor heat exchanger
8

Fig. 31

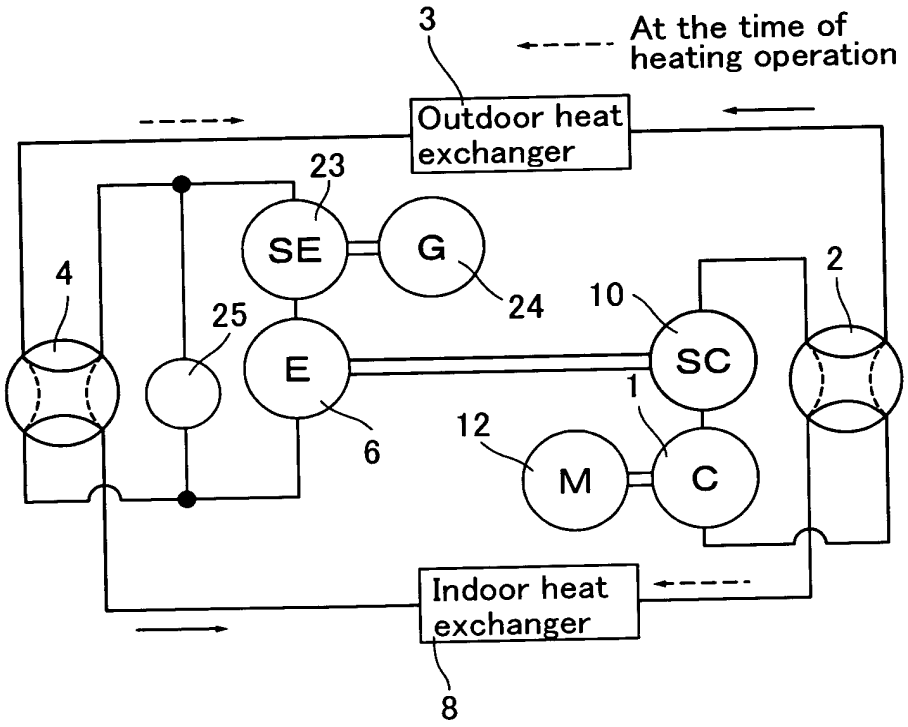

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
23
SE
G
4
24
10
2
25
E
SC
1
12
6
M
C
Indoor heat exchanger
8

Fig. 32

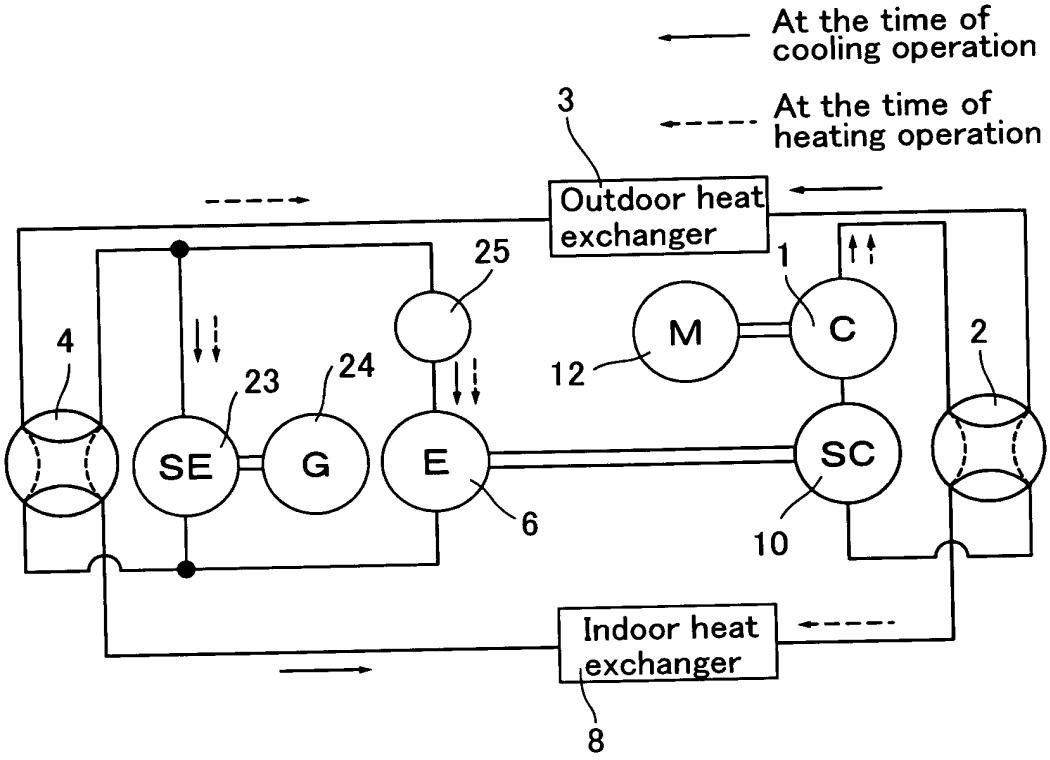

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
25
1
M
C
2
4
23
24
12
SE
G
E
SC
6
10
Indoor heat exchanger
8

Fig. 33

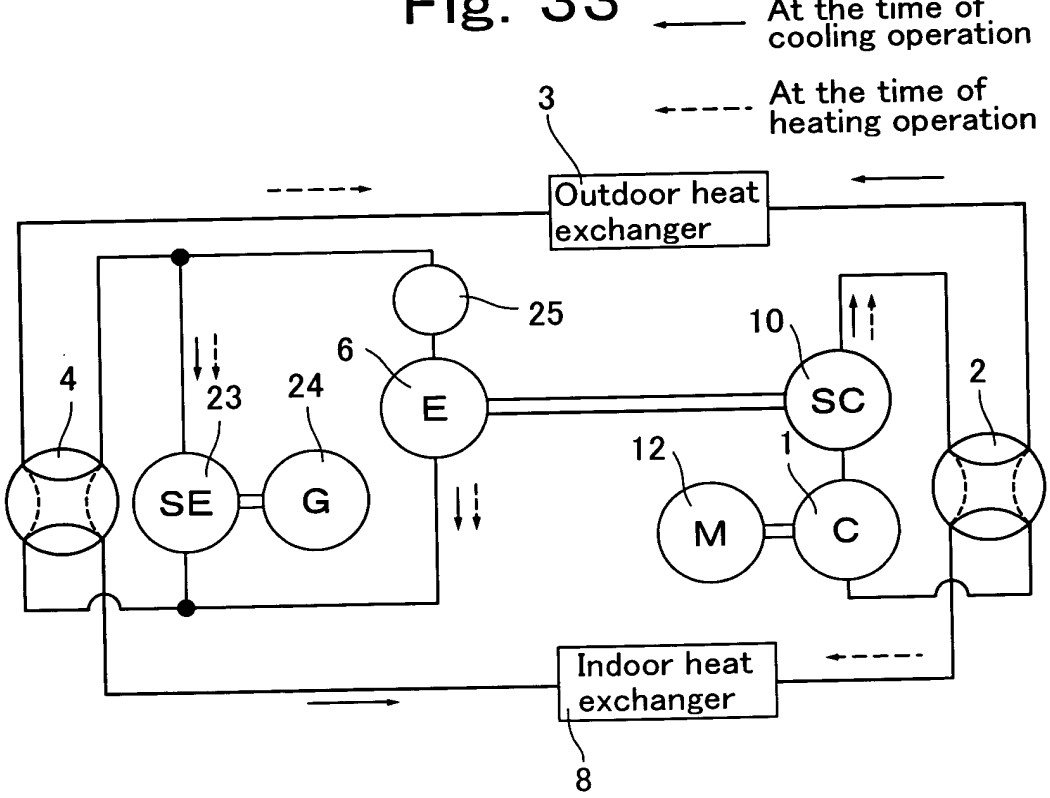

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
25
10
6
4
23
24
E
SC
2
12
1
SE
G
M
C
Indoor heat exchanger
8

Fig. 34

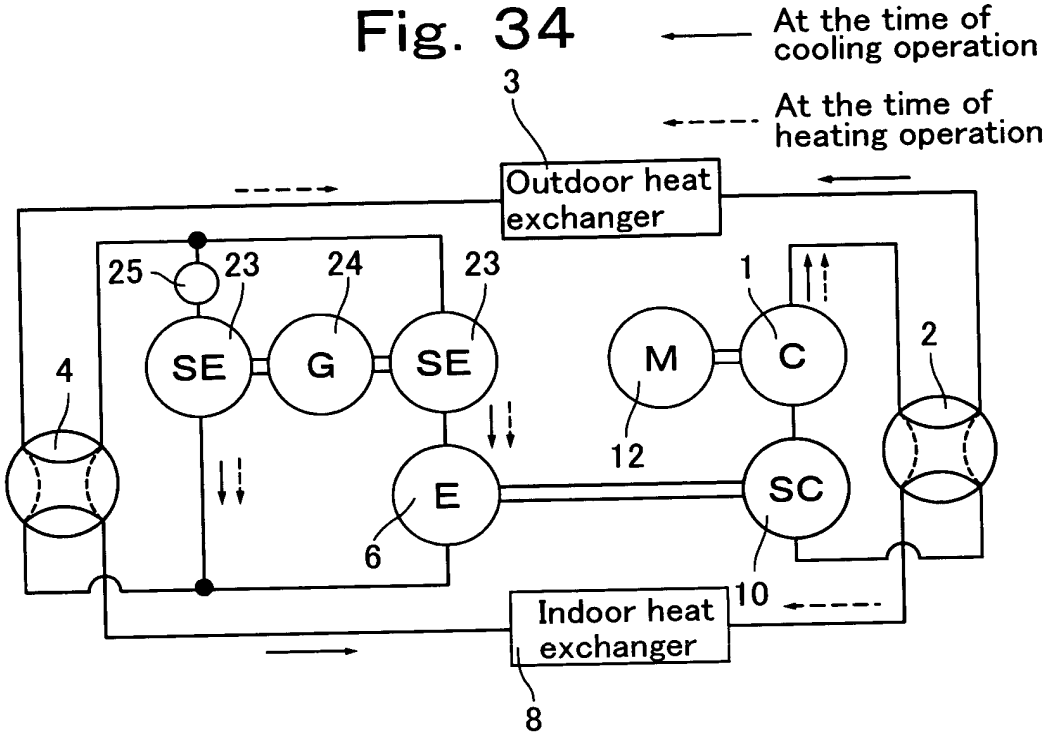

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
25
23
24
23
1
2
4
SE
G
SE
M
C
12
E
SC
6
10
Indoor heat exchanger
8

Fig. 35

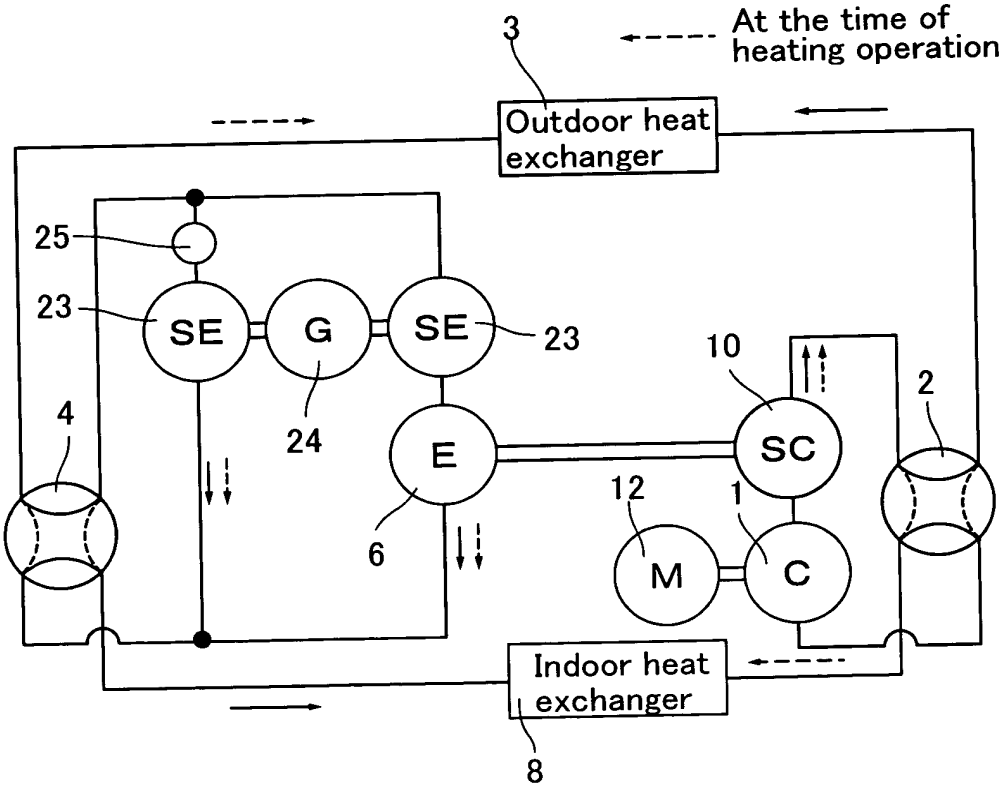

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
25
23
SE
G
SE
23
10
2
4
24
E
SC
12
1
6
M
C
Indoor heat exchanger
8

Fig. 36

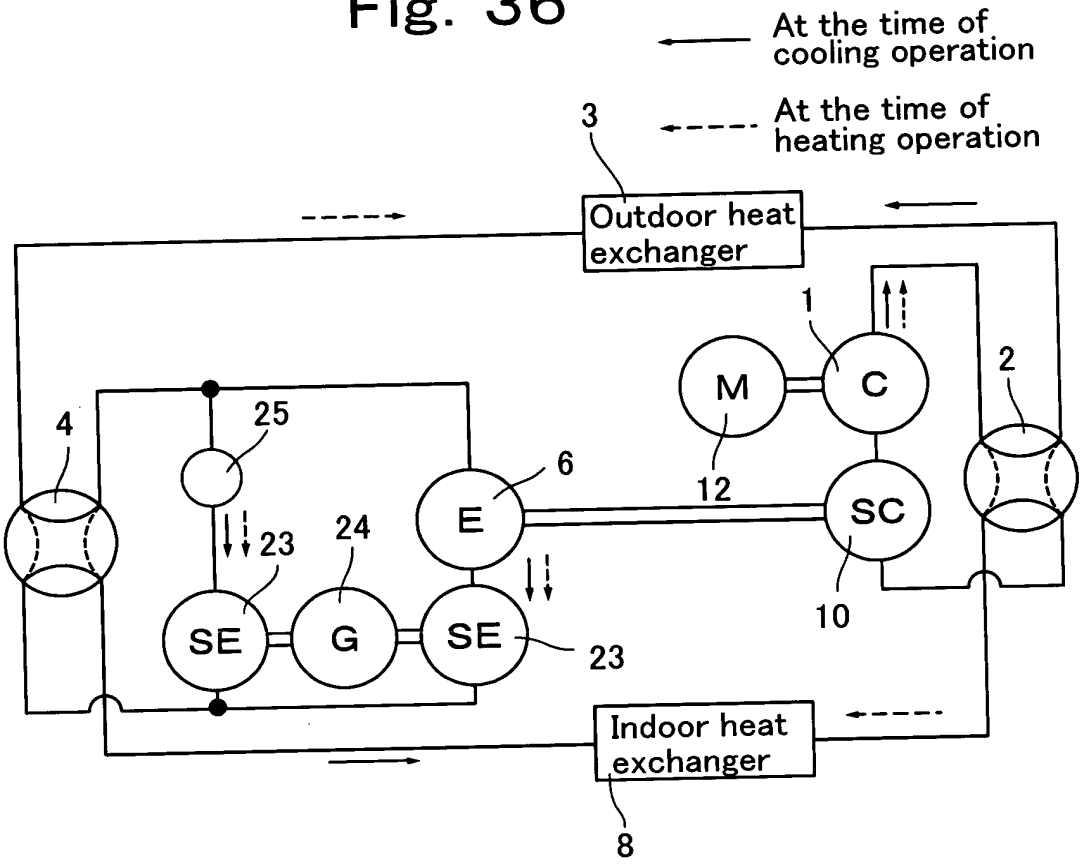

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
1
M
C
2
4
25
6
E
12
SC
23
24
SE
G
SE
23
10
Indoor heat exchanger
8

Fig. 37

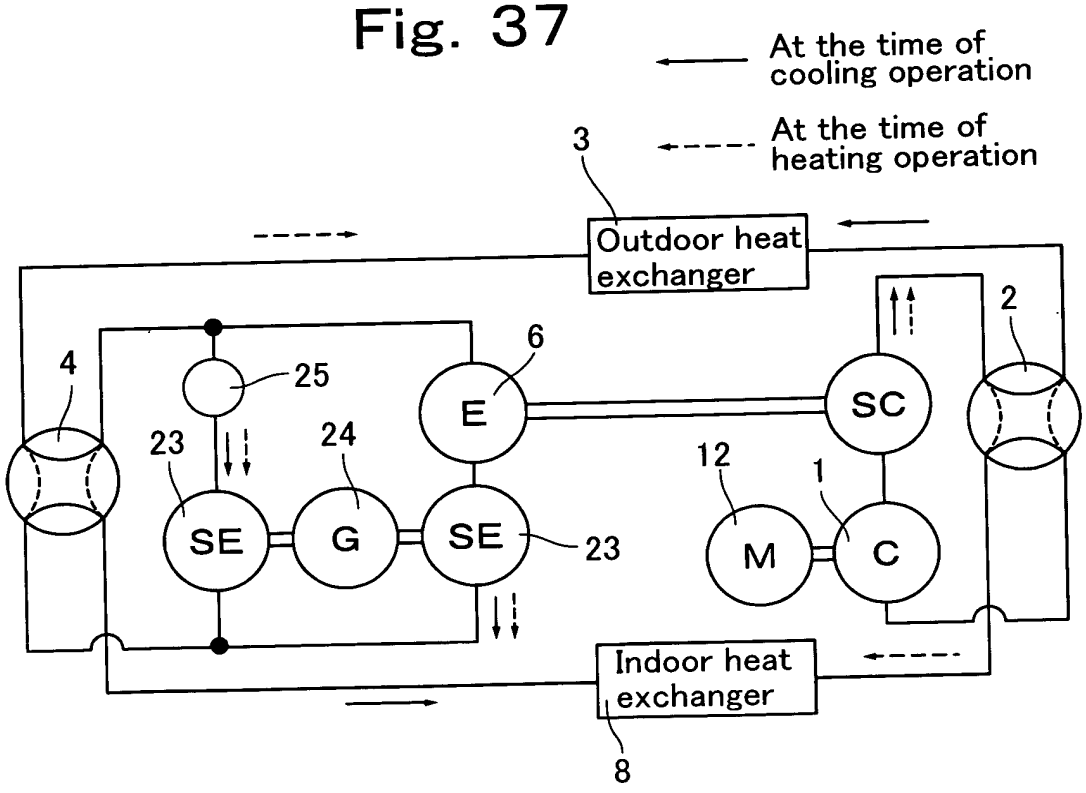

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
2
4
6
25
E
SC
23
24
12
1
SE
G
SE
23
M
C
Indoor heat exchanger
8

Fig. 38

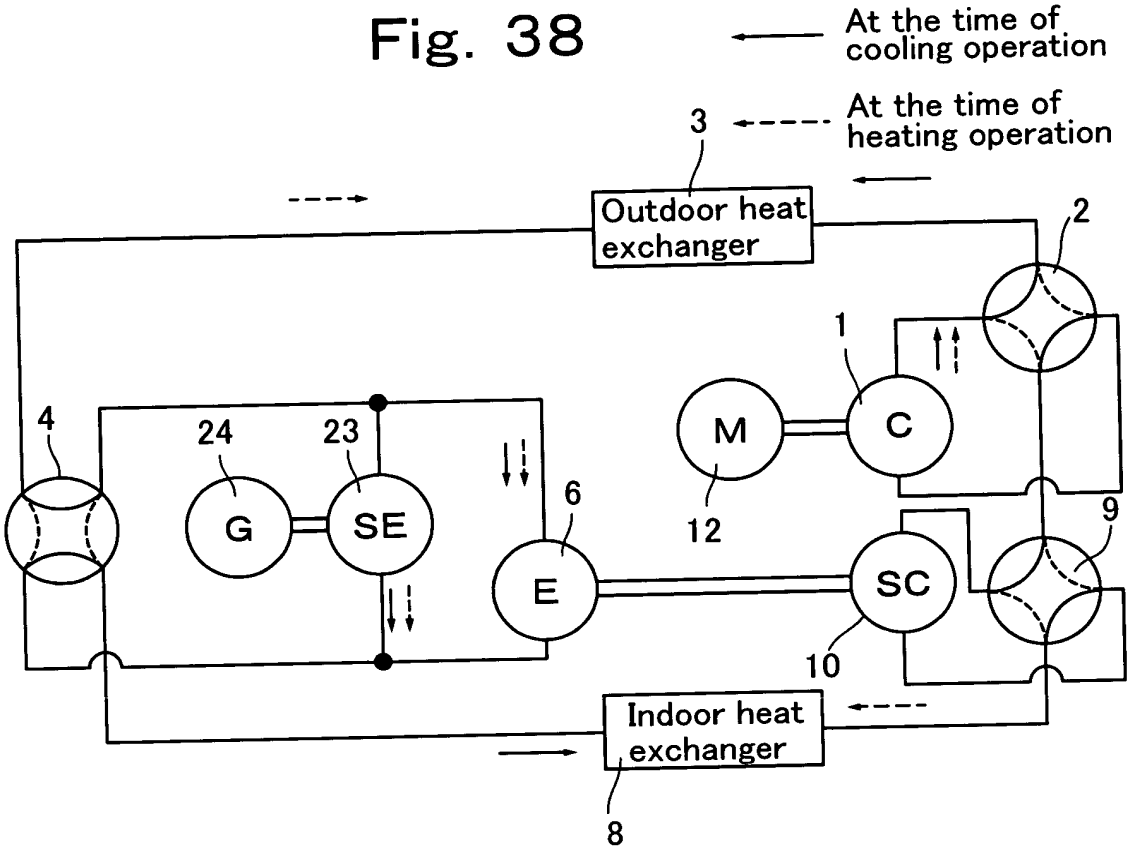

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
2
1
C
M
12
4
24
23
G
SE
6
E
SC
9
10
Indoor heat exchanger
8

Fig. 39

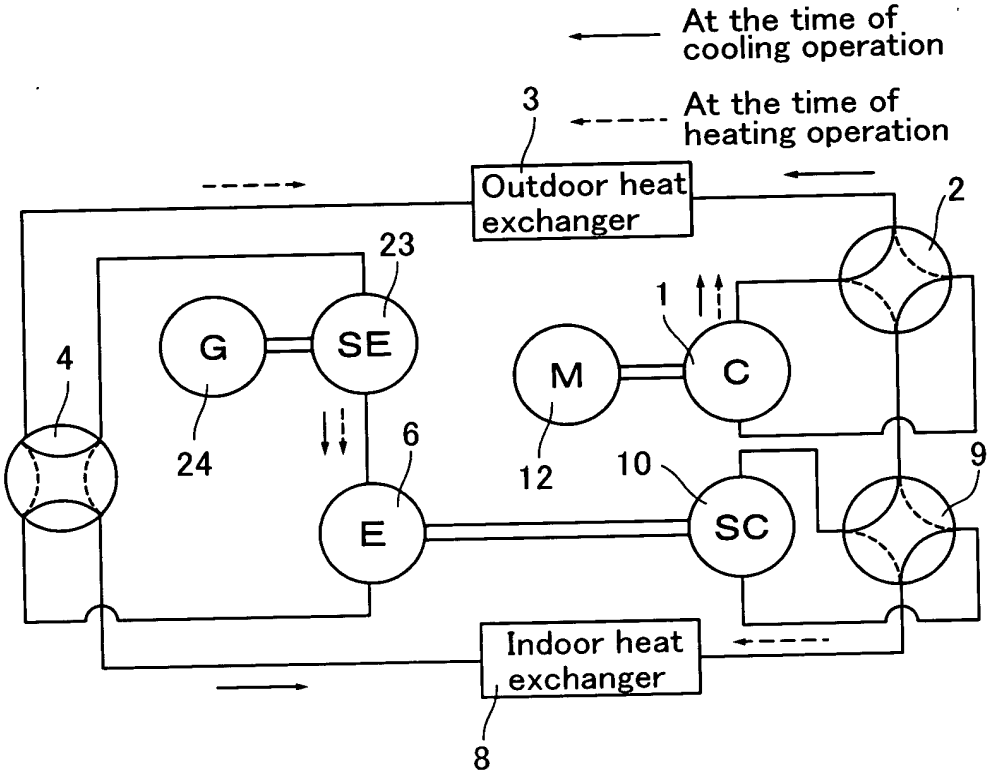

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
2
23
1
G
SE
C
M
4
24
6
12
10
9
E
SC
Indoor heat exchanger
8

Fig. 40

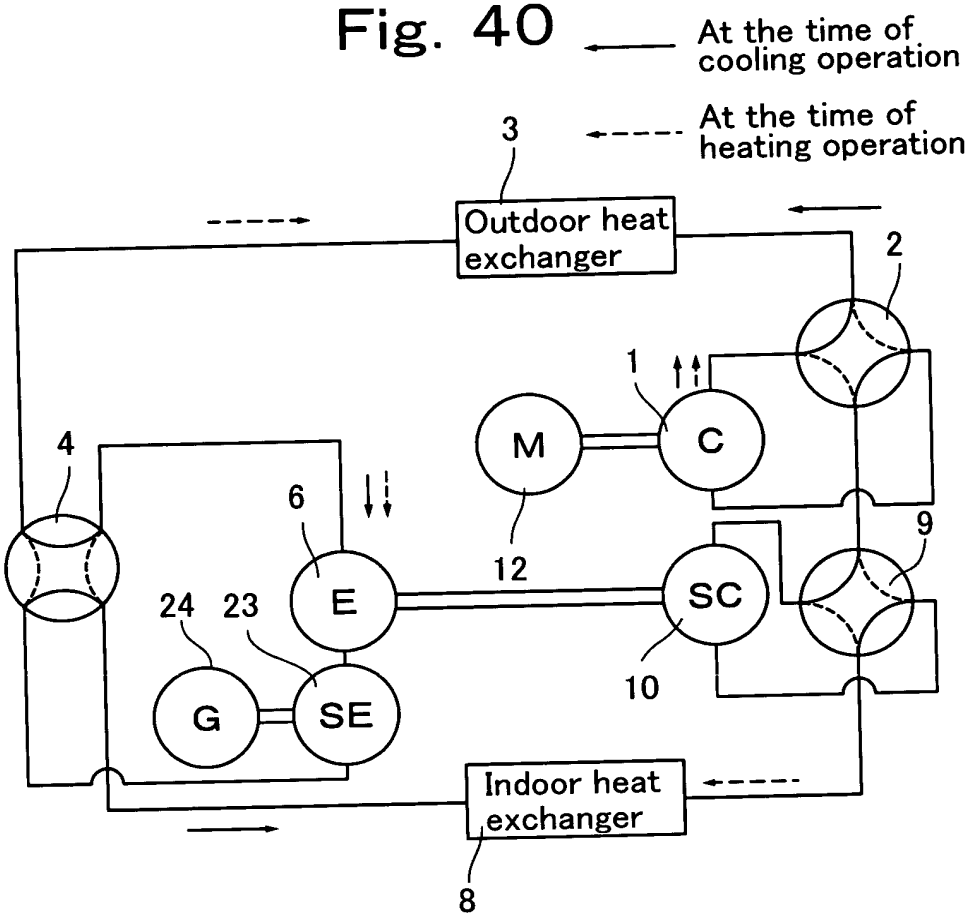

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
2
1
M
C
4
6
12
9
E
SC
24
23
G
SE
10
Indoor heat exchanger
8

Fig. 41

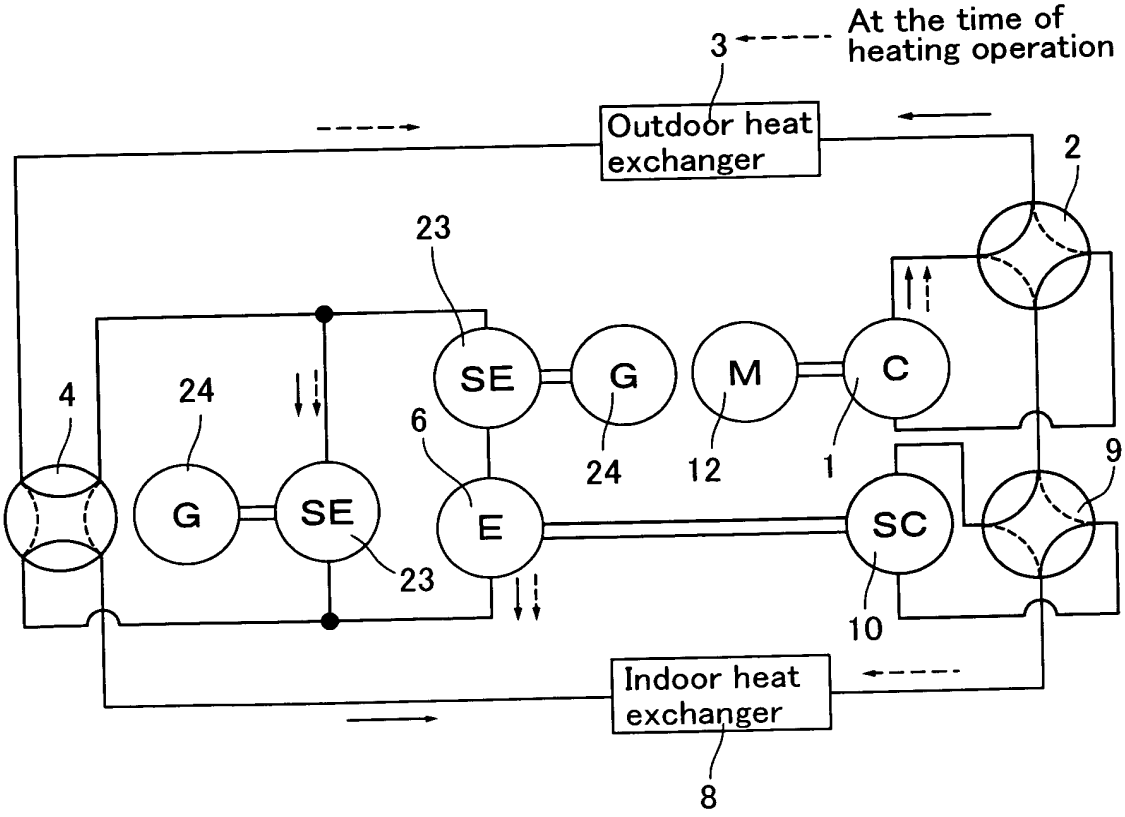

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
2
23
SE
G
M
C
4
24
6
24
12
1
9
G
SE
E
SC
23
10
Indoor heat exchanger
8

Fig. 42

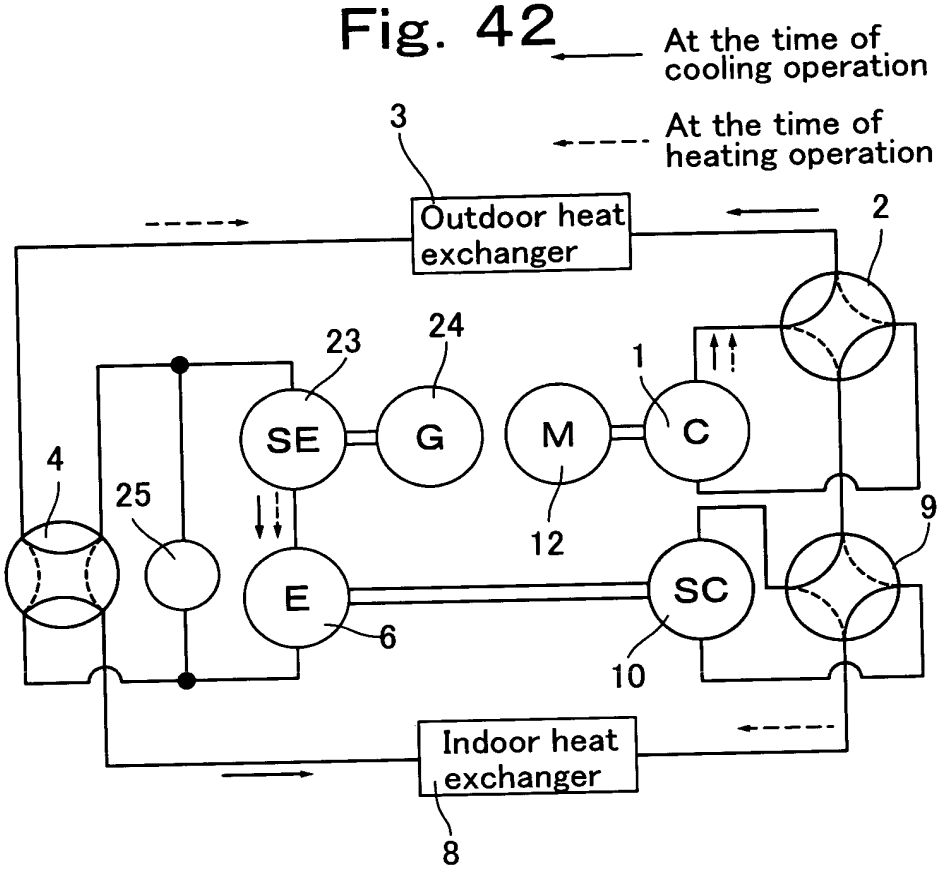

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
2
23
24
1
SE
G
M
C
4
25
9
12
E
SC
6
10
Indoor heat exchanger
8

Fig. 43

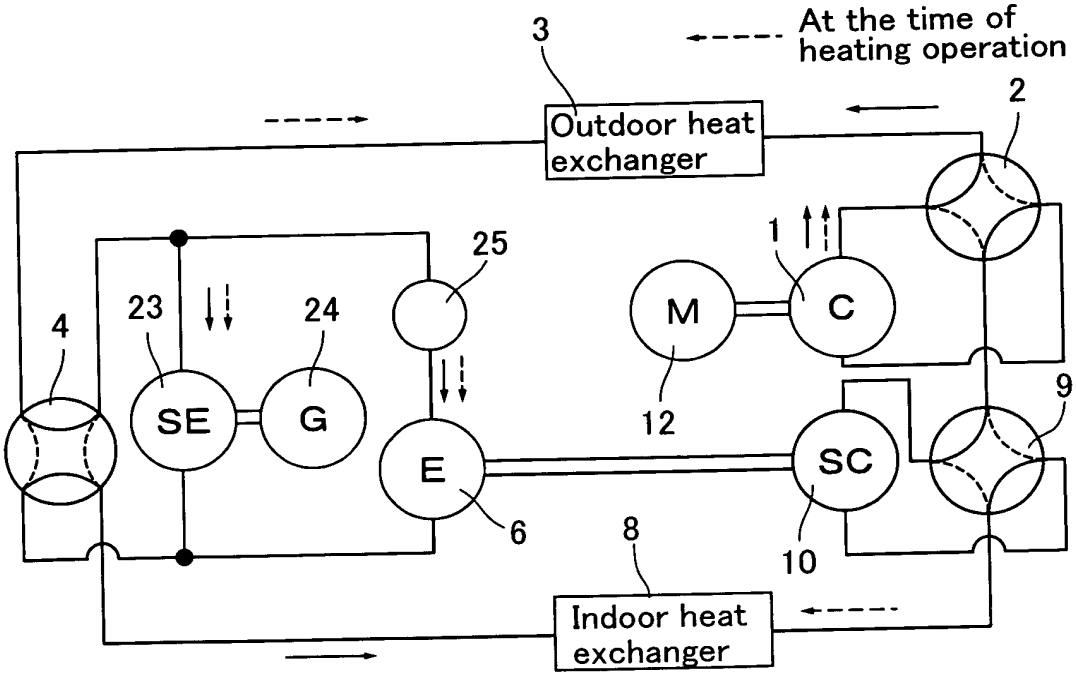

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
2
1
25
23
24
M
C
4
9
SE
G
12
E
SC
6
8
10
Indoor heat exchanger

Fig. 44

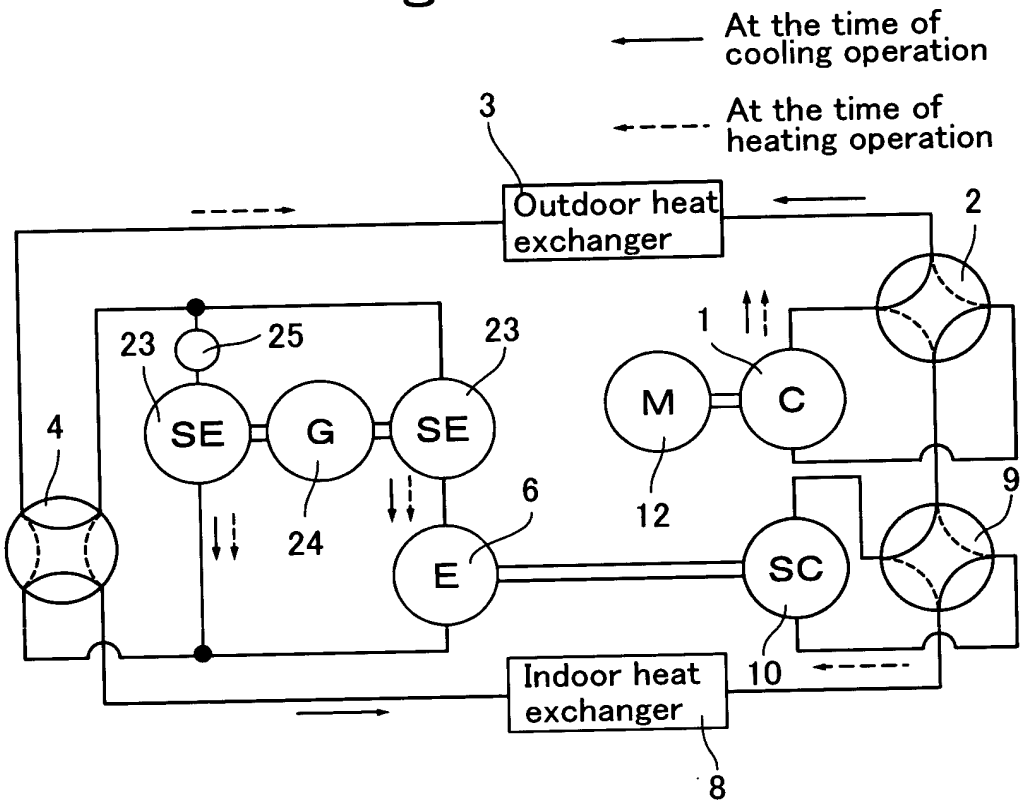
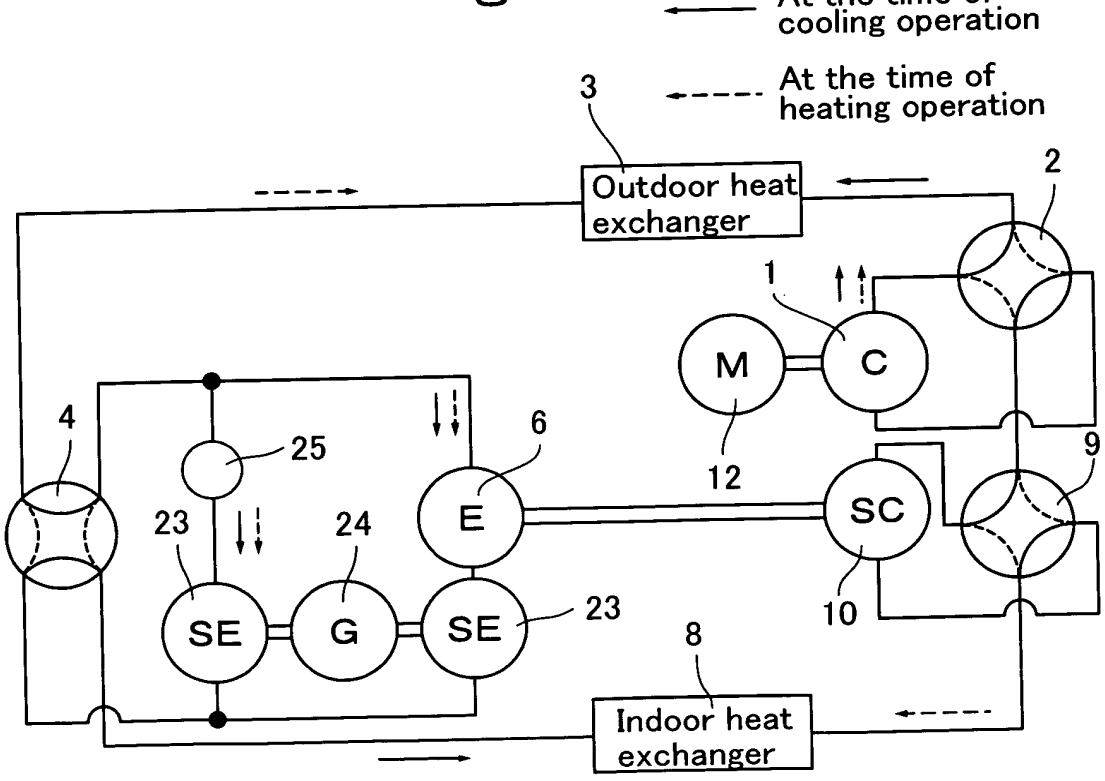

At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
2
1
23
25
23
M
C
4
SE
G
SE
6
9
12
24
E
SC
10
Indoor heat exchanger
8

Fig. 45


At the time of cooling operation
At the time of heating operation
3
Outdoor heat exchanger
2
1
M
C
4
25
6
9
12
23
24
E
SC
SE
G
SE
23
10
8
Indoor heat exchanger